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The Repellent Effects of Some Plant Powders on *Sitophilus Oryzae* (L.) (Coleoptera: Curculionidae) on Stored Rice in Thi -Qar Province, Southern Iraq.

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***Abstract*—The study showed the repellent effect of three types of plant powders, *Mentha*, *Myrtus* and *Ocimum basilica*, against rice weevil *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae), the results of the study showed that the *Myrtus* powder had the highest rate of repellent to insects. It reached the highest percentage of repellent outside the loop within 24 hours 41% at concentration of 6% where it was found that there was a significant difference in percentage compared to other plant powders (*Mentha, Ocimum basilica*) reached 39.5% and 37.5 %, respectively.**

Keywords*— the repellent effect, some plant, *Sitophilus oryzae

I. INTRODUCTION

Sitophilus oryzae (L.) has become primary pest of stored grains in warm climatic conditions. They cause damage to grains stored at 25-30 C° and at low Relative Humidity. These conditions are the best timed for the development of this pest [3].

The insect is described as small in size (2 to 3 mm) with a snout of long (1 mm) representing approximately (1/3) the length of her body. It can be distinguished by its reddish-brown to black color with four light yellow spots on the angles of the sheath wings. The sheath contains a set of longitudinal grooves as for its larvae. It is characterized by the absence of legs the dangerous of these beetles is their abilities to fly in adult instar [14], [20].

The adult insect fakes death when it senses danger, as it pulls its legs and falls to the ground. It has been shown through a lot of research that this insect prefers warm environments, it turns out that these insects are endogenous feeders (that is, the larvae feed and develop inside the healthy grain, and the adults feed and larvae are both on whole grain and grain products [19].

It was mentioned that the rice weevil is one of the main insects that infect rice, and it also infects wheat. Corn, rye, oats, barley, sorghum, dry beans and millet are also found feeding on walnuts, pistachios and almonds are also fed on grain products sources indicating that the origin of these insects is India, and then they spread around the world by exporting food such as pasta and aspic, especially when it is old. Its economic importance lies in the fact that pest spread all over the world [1].

In addition to the huge economic losses caused by the rice weevil, both(Bodroza and Govindan) [4], and [10] ,[5] they mentioned that the rice weevil caused losses in the quality of raw materials, final products and commercial value also affects the vitality of the seeds.

Pesticides is a method has been used to eliminate the stocking of insects in general and artificial fumigants like organo chlorines, phosphorous compounds, carbamates and pyrethroids, including toxic residues on cereals and foodstuffs and environmental pollution, what made the matter more complicated was the emergence of resistance of many insect pests to chlorine pesticides, in addition to its negative effects on non-target organisms, chlorine pesticides were banned in developed countries [17]. Researchers were prompted to use alternative methods to eliminate insects, specifically warehouse insects. Pesticides of plant origin were considered one of the alternatives in this field. it was used it in different forms, especially plant extracts and powders, as anti-feedant or other substances ,toxicants, growth inhibitors, attractants, or repellents. This alternative method represented the most developed method in the field of warehouse pest control because it leaves very low toxic effects on stored grains and food, its toxicity to mammals is very low, and reduces environmental pollution to minimum [8], [16].

However, their productions currently only meet very low percentages of the needs, and that agrees with the statistics issued by the competent statistical authorities in the Ministry of Agriculture and the Central Agency statistics, especially in the last five years, They found that the actual production of rye (rice) with its best represents only (15%) of the need, while we found that its production is constantly declining due to water scarcity as a result of the water policies adopted by Turkey and Syria in recent years. Its production in 2010 reached (84) thousand tons, and this covers only a modest percentage of the country's needs, while the country's need to (1.219) million tons. This means that there was a food gap of (1.135) million tons, which must be provided to cover the country's need for rice, (Central Statistical Organization, 2012). Whether this quantity is provided through production or import, the size of the losses resulting from the attack of rice by insect pests, especially the rice weevil, caused weight losses of up to

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about 10% in 30% in tropical areas, and this percentage gets worse under incorrect storage conditions. – temperate zones [13].

II. Materials And Methods

This experiment was carried out during the spring season of 2022 to study the repellent effect of powdered *Mentha* leaves, *myrtus communis* leaves and *Ocimum basilicum* leaves on the rice weevil (*Sitophilus oryzae)* (Coleoptera: Curculionidae) Table No. (1)

TABLE 1. PLANT SPECIES USED IN THE STUDY

The name	***The scientific name***	***Family name***	***Used part***
Minty	*Mentha*	Lamiaceae	Leaves
Myrtle communis	*Myrtus*	Myrtaceae	Leaves
Basil	*Ocimum basilicum*	Lamiaceae	Leaves

It went through two phases: -

A-Plant specimen collection and diagnosis:
The used plant samples were collected from the local markets. Samples were taken and washed from all the materials that may be on it. Then, they spread on newspapers separately on the shade until it dried.

B- Crushing and storing samples:
The plant samples were divided into small groups and then spread on a cloth at a temperature of 30 ± 2 °C and a humidity of 70 ± 5 g/cm^3. After the samples dried. they were crushed by an electricmill (Molinex) by means of a sieve size (0.6) mm, then keeping the powder for each plant inside a nylon bag marked with a paper indicating the place and time of collection withhe name of the plant. The bags were kept in the laboratory until use.

C-Setting up a permanent farm for a beetle (Sitophilus oryzae L.)
The insect was obtained from infected rice grains, and it was raised inside plastic containers of dimensions (15*9) cm. The holes of the containers were sealed with muslin to ensure that no insects could escape and to allow for ventilation.
We used rice grains for breeding after being subjected to freezing at a temperature of (-18°C) for two weeks to ensure elimination any possibility of other insect infestation [7].
Then, the insect was born on these grains at laboratory temperature (30±2°C), humidity (70±5g/cm3) to get a permanent farm from the insect [19].
As for the diagnosis of the insect, it was made according to the phenotypic characteristics mentioned by each of the[14], [18].

A - Test the repellent effect of plant powder

The modified [12]method was applied by placing a cardboard ring (4 cm in diameter * 0.5 cm in height) and the ring was fixed in the middle of a Petri dish (9 cm in diameter and 1 cm in height) on a filter paper.10 adults (5 males and 5 females) aged (1-14) days old were placed inside the ring with 10 g of food(rice) at concentrations of (2, 4,6) % w/w for each of the powder(*Mentha, Myrtus* and *Ocimum basilica*) separately and three replications either comparison treatment is placed 10 g of uninfected rice then calculate the number of complete insects outside the ring 24 hours after placing the wholes by calculating the number of whole insects outside the small dish and then calculating the percentage and my agency:
Rejection percentage = ((The ring outside the existing whole /total whole number)) *100

B- Statistical analysis

The data of the current study were analyzed using Microsoft Excel 2010. The statistical program spss and the chi-square law of independence at asignificant level <0.05.

Chi-Square $X^2 = \sum \left(\frac{O-E}{E}\right)^2$

III. Results and Discussion

Table (2) shows the percentages of the repellent effect of the used plants powders as the repellent effect varied according to the type of powder and the amount of concentration.
With regard to the type of powder, *Myrtus* powder outperformed in achieving the highest expulsion effect, as the rate of expulsion ratio reached 41.0while the ratio was39.5%, 37% For each of the powders of the *Mentha*, *Ocimum basilicum* , respectively.

In terms of concentrations, the highest percentage of repellent was achieved at 6% concentration. It reached 39.6% %, followed by concentrations of 4% and 2% with expulsion rates of 36.0%% and 24.5%, respectively.
All the above ratios showed significant differences from the comparison treatment, and thus all the used powders showed an insect repellent effect. It was also observed that the percentage of expulsion was directly proportional to the increase in the concentration for all the treatments. This result agreed with the results of [15], and Also, it agreed with what was reached in [6],[7]The powder of the seeds of rue, black pepper and fenugreek had a repellent effect for the rusty flour beetle when *(T. castaneum*)(Herbst) added to the food that was growen on it. A The percentage of expelled (43.3,43.0)% for fenugreek and black pepper, respectively, at the concentration of 6%.The process of expulsion means that there is one or more specific factors that affect the behavioral reactions of the insect, as indicated by Al- Mallah [2].

Some plants contain chemical compounds in their compositions that keep insects away from them through their effects on the olfactory organs of insects. The degree of insect response to it depends on the degree of its concentration in the plant. The strength of its permeability and the state of the insect's physiological and sensory systems affected by it. For example, it was found that

eucalyptus powder contains Ceneols, which is called Eucalyptol, has an aromatic smell that repels insects. It also helps plants as chemical defenses against insects, fungi and bacteria [11].

It was also shown from the table that the increase in the concentrations of the powders showed a direct relationship with the rates of the percentages of expulsion, and this is consistent with another study. In their study they found that 3 grams of black pepper caused the highest rate of expulsion of adult insects of the rusty flour beetle, which reached 9.685% with significant superiority over all the concentrations of the other [9] powders. They were shown good effectiveness in repelling the insect, as the percentage of red pepper and ginger in expelling the insect was good, as the 8.665% and 6.000%, respectively.

TABLE 2. THE REPELLENT EFFECT OF PLANTS POWDERS AGAINST *SITOPHILUS ORYZAE* (L.)

Plant type		Consentration			Total
		2%	4%	6%	
Menthe piperita	Count	20	26	30	76
	%	26.3%	34.2%	39.5%	100.0%
Myrtus communis	Count	26	46	50	122
	%	21.3%	37.7%	41.0%	100.0%
Ocimum basilicum	Count	22	28	30	80
	%	27.5%	35.0%	37.5%	100.0%
Control	Count	0	0	0	0
	%	0	0	0	0
Total	Count	68	100	110	278
	%	24.5%	36.0%	39.6%	100.0%

Cal.X2: 1.24 Tab.X2: 13.28 df : 4 P-value : 0.87

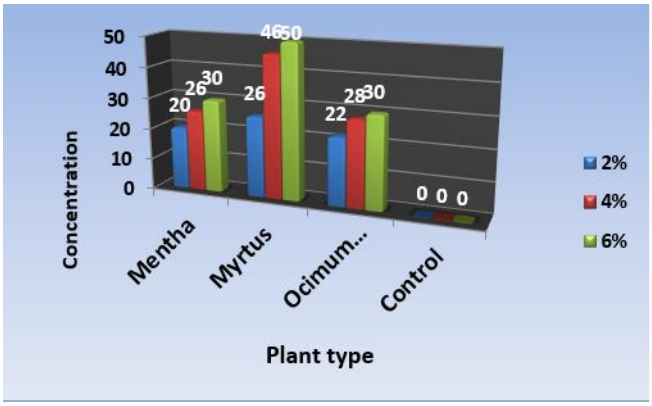

Fig. 1. SHOWS THE REPELLENT EFFECT OF THE THREE PLANT POWDERS UNDER STUDY.

IV. CONCLUSION

Sitophilus oryzae (L.) is a dangerous pest that must be eliminated by safe, scientific methods, The best method was to use different concentrations of plant powders, as they have no side effects.

Most cases of food poisoning may be due to the presence of warehouse insects with food, as their secretions and skins that remain repeatedly on food lead to contamination.

Insect residues in grains lead to an increase in the percentage of urea, which is a toxic substance that changes the components of the grain and lead to difficulties in the grinding process, and hinders Ventilation. Also, it affects absorbing moisture and helping in raising the water content of the grain, and weakens the effect of the plant powder used to combat pests.

CONFLICT OF INTEREST

Authors declare that they have no conflict of interest.

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