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Evaluation of the efficacy of Decise and *Rosmarinus afficinalis* oil with *Brevibacillus laterosporus* and their mixtures against the larvae of the cotton spiny boll worm *Earias insulana* (Boisd) in vitro

Salih Kh. Atiyha[1*], Mohammed S. Mansor[2] , and Abdullah A. Hassan[2]

1 Ministry of Education, Salah al-Din Education Directorate, Iraq
2 Tikrit University, College of Agriculture, Plant Protection Department, Iraq

*Corresponding author: E-mail salihkhalaf92@gmail.com

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: Pesticide decise Rosemary *oil R.afficinalis* Bacteria *B. laterosporus* Insect Cotton spinyboll worm *E.insulana*

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ABSTRACT
The study was conducted to evaluate the compatibility and efficacy of decise and rosemary oil *R.afficinalis* with *B. laterosporus* against the larvae of the cotton spiny boll worm *E.insulana*. The results showed the compatibility of decise and rosemary oil *R.afficinalis* with *B. Laterosporus* a significant increase in the numbers of bacterial colonies As it reached 18.26 and 30.43 bacterial cells / ml with the insecticide for the recommended concentration and below the recommended and 3.47, 25.21, 34.78, 47.82 and 59.13 bacterial cells / ml with corona oil for concentrations (1000, 2000, 3000, 4000 and 5000) mg / L The interaction of bacteria treatment only at a concentration of 1.9×10^{10} insecticide at a concentration of 400 mg / L, and rosemary oil at a concentration of 5000 mg / L gave the highest mortality rates of 63.33, 66.66, and 53.33%, respectively, after five days of treatment, followed by the same concentrations above. With a mortality rate of 70.00, 80.00 and 63.33%, respectively, after seven days of treatment, while no mortality rate was recorded for the treatment of bacteria and rosemary oil at a concentration of 1.9×10^{6} and 1000 mg / L after one day. The interaction of concentration mixtures of the insecticide with the bacteria at 400 mg/L, the insecticide with oil at 400 mg/L, and rosemary oil with the bacteria at 5000 mg/L gave the highest mortality rates of 90.00, 93.33, and 76.66%, respectively, followed by a concentration of 400 mg/L of the pesticide with the bacteria. And 400 mg / L with oil and 5000 mg / L for oil with bacteria, which amounted to 70.00, 73.33 and 66.66%, respectively, while the lowest percentage of mortality was at concentrations of 200 mg / L for the insecticide with bacteria and oil and 1000 mg / L for the extract with bacteria, which it reached 6.66, 10.00 and 0.00%, respectively. The results of the compatibility showed that decise and rosemary oil, *R. officinalis*, gave a significant increase to the numbers of *B. laterosporus*. while the results of insect mortality rates increased with the duration of exposure within seven days for each of the treatments and their mixture, and this gives good efficiency of the insecticide and oil with bacteria towards *E.insulana* insect, which is included in the modern trends of integrated pest management.

قييم كفاءة مبيد Decise وزيت أكليل الجبل *Rosmarinus afficinalis* مع بكتريا *Brevibacillus laterosporus* ومخاليطهم ضد يرقات دودة جوز القطن الشوكية (Boisd) *Earias insulana* مختبرياً

صالح خلف عطيه[1] ومحمد شاكر منصور[2] وعبدالله عبدالكريم حسن[2]

1 وزارة التربية , مديرية تربية صلاح الدين ، العراق

2 جامعة تكريت ، كلية الزراعة ، قسم وقاية النبات ، العراق

الخلاصة

اجريت الدراسة في جامعة تكريت / كلية الزراعة لتقييم توافقية وكفاءة مبيد decise و زيت أكليل الجبل *R .afficinalis* مع بكتريا *B. laterosporus* ضد يرقات حشرة دودة جوز القطن الشوكية *E.insulana* ، بينت نتائج توافقية مبيد decise وزيت أكليل الجبل *R .afficinalis* مع بكتريا *B. Laterosporu* زيادة ملحوظة في أعداد مستعمرات البكتريا إذ بلغت 23.47 و79.13خلية بكتيرية / مل مع المبيد للتركيز الموصى به وتحت الموصى و3.47 و 25.21 و 34.78 و 47.82 و 59.13 خلية بكتيرية / مل مع زيت أكليل الجبل للتراكيز (1000و 2000 و 3000 و 4000 و 5000) ملغم / لتر ، أعطت تداخل معاملة البكتريا فقط عند التركيز1.9 × 10 ^{10} ومبيد decise عند التركيز 400 ملغم / لتر وزيت أكليل الجبل عند التركيز 5000 ملغم / لتر أعلى نسب هلاك بلغت 63.33 و 66.66 و 53.33% على التوالي بعد خمس أيام من المعاملة تليها نفس التراكيز أعلاه بنسبة هلاك بلغت 70.00 و 80.00 و 63.33% على التوالي بعد سبعة أيام من المعاملة ، بينما لم تسجل إي نسبة هلاك لمعاملة البكتريا وزيت أكليل الجبل عند التركيز 1.9 × 10 ^{6} و 1000 ملغم / لتر بعد واحد يوم . أعطت تداخل مخاليط تراكيز للمبيد مع للبكتريا عند 400 ملغم / لتر والمبيد مع زيت عند 400 ملغم / لتر وزيت أكليل الجبل البكتريا عند 5000 ملغم / لتر أعلى نسب هلاك بلغت 90.00 و 93.33 و 76.66% على التوالي يليها تركيز 400 ملغم / لتر للمبيد مع البكتريا و 400 ملغم / لتر مع الزيت و 5000 ملغم / لتر للزيت مع البكتريا والتي بلغت 70.00 و 73.33 و 66.66 %على التوالي ، بينما كانت أقل نسبة هلاك عند التراكيز 200 ملغم / لتر للمبيد مع البكتريا و الزيت و1000 ملغم / لتر للمستخلص مع البكتريا والتي بلغت 6.66 و10.00 و 0.00 % على التوالي ، أظهرت نتائج التوافقية أن مبيد decise وزيت أكليل الجبل *R .afficinalis* قد أعطت زيادة ملحوظة لأعداد بكتريا *B. laterosporus*. ، بينما أعطت نتائج نسب القتل المئوية للحشرة زيادة مع مدة التعريض خلال سبعة أيام لكل من المعاملات وخليطهم وهذا يعطي كفاءة جيدة للمبيد والزيت مع البكتريا ضد دودة جوز القطن الشوكية *E.insulana*، والتي تدخل في الاتجاهات الحديثة لإدارة المتكاملة للآفات.

الكلمات المفتاحية : مبيد decise زيت أكليل الجبل *R .afficinalis* وبكتريا *B. laterosporus* حشرة دودة جوز القطن الشوكية *E.insulana* .

INTRODUCTION

The cotton spiny boll worm *E.insulana* is one of the pests that Infest cotton, okra, baker, jute, jute, and seal. It Infest the developing tops, flower buds, and flowers. The damage of this insect comes from feeding its larvae on leafy buds, plant tissues, and juicy leaves, leading to wilting and drooping of its leaves, and then it dries up and prevails. Its color with the larvae remaining inside it, then moving to the flower buds, causing them to fall off, attacking the boll in the cotton and piercing it to feed on the seeds. The same applies to the okra fruits, and it continues to grow and moult until it passes its five instars (Arabs *et al.*, 2018). Many researchers around the world dealt with combating adults and larvae This insect was controlled by the use of

organic chemical insecticides belonging to the groups of phosphorus, pyrethroid and carbamate insecticide in the control of the cotton spiny boll worm, as the cotton boll worms showed resistance against most of these insecticides, in addition to the high cost of these insecticide (Ramaubramanyam, 2004) in addition to the use of agricultural methods, but all of these methods did not limit the damages of this pest, so the world turned towards finding environmentally friendly chemical and biological compounds produced naturally from microorganisms and plants that were classified as biopesticides, which are characterized by their high safety on humans and beneficial organisms and the speed of their destruction in the ecosystem as well as their high effectiveness in combating various insects. and on different crops within integrated pest management programs (Aktar *et al*., 2009; Fernandez *et al*., 2010; Huang *et al*., 2020) that the use of natural compounds of plant origin plant extracts is one of the recent trends that have proven efficient in controlling insect pests, for these compounds there are multiple ways of affecting the target insect that included direct toxicity, the effect on the growth and development of the insect, inhibitors of nutrition, the effect in preventing the maturation of Laying eggs and the effect on female fertility (Halawa, 2006), the bacteria *B. laterosporus* showed high efficiency in controlling several orders of insects, including the two-order, Coleoptera, Hemiptera and scaly-winged, especially mosquitoes, and it caused a death rate of 93.33% of the larvae of the cotton spiny boll worm and is considered a bacterium inside the plant *B. laterosporus* is one of the recent trends that have proven its efficiency in resisting many diseases and plant pests (Favret and Yousten, 2011; Hassan *et al*., 2022) due to the importance and damage of the cotton spiny boll worm on the okra plant. This study was conducted to evaluate the compatibility of decise and rosemary oil. *R.afficinalis* with *B.laterosporus* against this insect in the laboratory.

MATERIALS AND METHODS

Source and culture of the insect in the laboratory

Insect larvae were collected from infested okra plant pods from several fields in Baiji district, placed in plastic boxes and transported to the laboratory, after which they were reared in the laboratory at a temperature of 27 + 2 C and a relative humidity of 30-50% in a plastic container 20 cm high, 40 cm long and 40 cm wide. 30 cm floor covered with a thin layer of soil, then the larvae were fed on fresh okra pods until they reached the pupae. the pupae were transferred to a glass box with dimensions (50 x 50 x 50) cm, which contains two side openings with dimensions (20 x 20) cm, with a thin layer of the soil is furnished at the bottom. A 50 cm long white burlap cloth covered with burlap cloth containing fresh pods is fixed on it, in order to lay eggs on it and at the same time it is feeding for the larvae with the availability of the necessary moisture for that. After the adults came out, they were fed with a 10% sugar solution and a 5% honey and water solution in a 10 ml plastic tube that was covered with cotton and fixed to the wall of the glass box from the inside. After 4-5 days, the eggs hatched into larvae of the 1st instar, which were transferred to special plastic cups. For

breeding caterpillars, circular in shape, with dimensions (10 x 7) cm. Then 10 larvae were placed in each box, and the diet was changed every two or three days, and they were monitored daily until they reached the 3rd larval instar age and isolated for the purpose of conducting vital tests on them. (Al-Jubouri, 2019)

Phenotypic diagnosis of *E. insulana* (Biosd) : The phenotypic diagnosis was made according to the book of the Natural History Center and Museum / University of Baghdad, No. 687 on 9/29/2021

Chemicals and vegetable oils used in the compatibility of *B. laterosporus*

Chemicals and vegetable oil

Decise 10 EC : Active ingredient: Deltamethrin 10 EC, Chemical group: Pyrethroid, Producing company: Bayer, Germany, Recommended field rate: 0.175 ml / liter The chemical composition of the insecticide: C22H19Br2NO3

Decise pesticide preparation method: Concentrations were prepared (200, 250, 300, 350, 400) mg / L, which were approved after the initial tests on the insect, and we start with the lowest concentration until the highest by treating the larvae of the cotton spiny boll worm.

Rosemary oil *R.officinalis*

How to prepare rosemary oil: Rosemary oil, *R. officinalis*, produced locally by Imad-Mosul Company, was used in compatibility experiments and biological tests at concentrations (1000, 2000, 3000, 4000, 5000) ml/L after preliminary biological tests against the larvae of the cotton spiny boll worm, and Tween was used to dissolve Oil with water and the surface tension fracture between oil and water for the above concentrations

Adding concentrations of chemicals and vegetable oils to the growth medium of *B. Laterosporus*

The recommended and below recommended decise pesticide concentrations (0.175 and 0.85) ml / L were used in the compatibility test according to the manufacturer's instructions, while I used rosemary oil *R. officinalis* with concentrations (1000, 2000, 3000, 4000, 5000) ml/L resulting from the preliminary tests against Cotton spiny nut worm. As for bacteria,1ml of concentration was used 1.9×10^{10} bacterial cells/ml .

Compatibility test of decise and rosemary oil, *R. officinalis*, with *B. laterosporus*

The bacterial suspension was prepared by taking a swab with a bacterial vector from a 24-hour-old active bacterial culture, then cultured in N.B nutrient broth medium and incubated for 24 hours, then 1 ml of N.B medium was taken and placed in 9 ml distilled water to become one dilution, and this process continued until Reaching a dilution of 1.9×10^{10} bacterial cells / ml, then placing 1 ml of this dilution

in Petri dishes, then pouring the previously prepared N.A nutritional medium with the addition of the tested substance according to the concentrations used for oil and pesticide in paragraph (2.4) with a movement in the form of number 8 to ensure Homogenization of the distribution of the diluted bacterial suspension with the medium. Three replications were made for each treatment of the studied additives and for each concentration as well as the comparison treatment (without adding pesticide and oil), then the dishes were incubated at a temperature of 37 ° C for a period of hours. The number of colonies was estimated after a period of time. Incubation by multiplying the number of colonies x the reciprocal of the dilution (Al-Jubouri, 2019)

$$\text{of colonies growth} = \frac{\text{The number of colonies to be treated with the pesticide}}{\text{Number of colonies compared}} \times 100\ \%$$

of inhibition = -100% of growth %

Evaluation of the effect of several concentrations of *B. laterosporus* bacteria on the third instar larvae of the cotton spinyboll worm *E.insulana*

The experiment was conducted to evaluate the vitality of *B. Laterosporus* bacteria on the larvae of the spiny boll worm by applying five concentrations of bacteria, including 1.9×10^6, 1.9×10^7, 1.9×10^8, 1.9×10^9, and 1.9×10^{10} bacterial cells/ml. Three replicates of okra pod insect food were placed in plastic cups and sprayed with the mentioned concentrations. The percentage of mortality g was calculated after 1, 3, 5, 7 days of treatment and corrected according to the (Schneider and Orell) equation (Mallah and Al-Jubouri, 2014)

$$\text{Corrected mortality rate \%} = \frac{\text{mortality in transaction - mortality in comparison}}{\text{mortality in comparison - 100}} \times 100$$

Evaluation of the effect of several concentrations of decise on *B. Laterosporus* at a concentration of1.9×10^{10} bacterial cells / ml against the third instar larvae of the cotton spiny boll worm *E.insulana*

The experiment was conducted to evaluate the decise insecticide with *B. Laterosporus* bacteria on the larvae of the cotton spiny boll worm. Five concentrations of ml/L were made that included 200, 250, 300, 350 and 400 of the insecticide and a concentration of 1.9×10^{10} bacterial cells /m After that, the okra pods were treated. (surface sterilized with sodium hypochlorite, concentration 3%, for one minute) inside plastic cups with five pods (weighing 10 g per pod) using the above concentrations, each separately in three replications, then 10 third-instar larvae

were transferred to them, and then the percentage of mortality was calculated after 1, 3, 5, 7 days of treatment and corrected according to (Schneider and Orell)

Evaluation of the effect of *B. Laterosporus* with rosemary oil, *R. officinalis,* at a concentration of 5000 mg /L on the third instar larvae of *E.insulana*To evaluate *B. laterosporus* with rosemary oil on cotton boll larvae

Five concentrations were made, including 1.9×10^6, 1.9×10^7, 1.9×10^8, 1.9×10^9, and 1.9×10^{10} bacterial cells / ml of bacteria and a concentration of 5 ml of the extract. After that, the okra pods (surface sterilized) were treated with hypochlorite. Sodium concentration (3%) for one minute) inside plastic cups with five pods (weighing 10 gm per pod) using the above concentrations separately in three replications, then 10 third-instar larvae were transferred to them, and then the percentage of mortality was calculated after 1, 3, 5, 7 days of treatment and corrected according to (Schneider and Orell) equation .

Statistical analysis

The analysis used was the complete random design C.R.D system, and the averages were compared using Dunkin's multinomial test under the probability level of 0.05. The statistical program (2001.S.A.S) was used to analyze the results of factorial experiments.

RESULTS AND DISCUSSION

The results of table (1) showed that decise and rosemary oil were compatible with *B. Laterosporus*, as among the decise herbicide with a concentration below the recommended, the highest increase in bacterial numbers was 79.13 bacterial cells / ml, followed by decise with the recommended concentration of 23.47 bacterial cells / ml and rosemary oil at a ratio of 3.47, 25.21, 34.78, 47.82, and 59.13 bacterial cells/ml at concentrations 1000, 2000, 3000, 4000, 5000 mg/L, respectively. the interpretation of the results is attributed to the fact that the increase in the numbers of bacteria during mixing with chemicals and vegetable oils is due to the fact that these bacteria are not affected by these materials, and this is due to the presence of alkaloid compounds in the oil as well as other chemicals present in the pesticide such as carbon and chlorine that the bacteria need in the production process. Energy also makes the medium of reproduction for bacteria alkaline and suitable for its growth and reproduction, in addition to some compounds that bacteria use as food in their growth and reproduction, such as glycosides, glucose, vitamin C, oils, and Quercetin from flavonoids. These results agree with Al-Baldawi (2023), who indicated that the compatibility of chemicals such as decise pesticides, surfactants, oils, and plant extracts may be due to the fact that bacteria may possess some enzymes that metabolize and decompose these added substances into secondary metabolites that bacteria use as an important food source for their growth and reproduction. Also, (Al-Rafaie, 2018) indicated that vegetable oils (neem oil, castor oil, and cologne oil) have a stimulating effect on the growth and multiplication of bacteria and caused an

increase in the number of colonies of B. 278.60%, followed by neem oil and castor oil. With an increase rate of 187.65 and 103.70%, respectively, and (Ismail, 2017) showed that the extracts of rosacea and oleander, neem and castor oils were compatible with *B. thuringiensis var kurstaki* and increased the number of colonies at rates of 78.95, 632.89, 314.47 and 393.42. % respectively.

Table (1) Compatibility of decise and rosemary oil, *R. officinalis*, with *B. laterosporus*

Additive	concentration ml / liter	number of colonies (^{12} 10 ×X)	Reduction or increase %
decise	0.175	1.42f	+23.47
	0.85	2.06a	+79.13
	1000	1.19g	+3.47
	2000	1.44e	+25.21
	3000	1.55d	+34.78
R .afficinalis	4000	1.70c	+47.82
	5000	1.83b	+59.13
Bacteria only (comparison)	1	h1.15	_

Similar lowercase letters in a column or row indicate that there are no significant differences according to Duncan's multiple range test at a probability level of 5%

The results of table (2) showed that there were significant differences in the mortality rates between the average concentrations, as the average concentration of 400 mg / L showed the highest mortality rate, which amounted to 52.50%, followed by the concentration of 350 mg / L, which amounted to 43.33%, while the lowest mortality rate was at the average concentration of 200 mg / L, which It reached 25.83%, and the average time periods after 7 days of treatment showed the highest mortality rate, which amounted to 48.88%, followed by the average time period after 5 days of treatment, which amounted to 39.44%, while the lowest mortality rate was at the time period of 1 day, which amounted to 10.00%. As for the overlap Between concentrations and time periods, the overlap of the concentration 400 mg / L after 7 days of treatment showed the highest mortality rate, which amounted to 80.00%, followed by the same concentration after 5 days of treatment, which amounted to 66.66%, while the lowest mortality rate was in the concentration 200 mg / L after 1 day of treatment. The treatment, which amounted to 3.33% in addition to the control, did not achieve any mortality rate for the insect, and the interpretation of the results is due to the mechanism of the toxic effect of the Decise insecticide, which causes paralysis of the treated larvae, i. And the conduction of nerve signals in the nervous system of the insect, and this results in a prolonged permeability of the nerve to the element sodium, which leads to a series of repeated nerve signals in the sensory organs, sensory nerves, and muscles, which leads to the death of the treated insect, and this is similar to what between Raad (2022) that the results of the overlap between the different concentrations of the insecticide movento The duration of exposure led to significant differences, the highest corrected mortality rate for third-age tomato moth larvae at concentration 80 and 70 ppm after 7 days of treatment amounted to 100

and 97.78%, respectively. ppm 80 reached 91.66%, while the lowest average mortality rate for larvae at a concentration of 40 ppm was 54.39. He explained the results that the active substance Spirotetramate inhibits the biosynthesis of special fats, especially triglycerides and free fatty acids, which leads to incomplete moulting of non-molecular stages. complete and therefore dead.

Table (2) Evaluation of the effect of several concentrations of Decise against the third instar larvae of the cotton spiny boll worm *E.insulana*.

Concentration mg/l	(%) Corrected mortality rate				General concentration mean
	Exposure period (days)				
	1 days	3 Days	5 days	7days	
200	3.33 no	23.33 kl	30.00 jk	46.66 efg	25.83 D
250	6.66 no	30.00 jk	40.00 ghi	50.00 efg	31.66 C
300	10.00 lm	33.33 ij	43.33 fgh	53.33 de	35.00 C
350	16.66 lm	36.66 ijk	56.66 cd	63.33 bc	43.33 B
400	23.33 kl	40.00 ghi	66.66 b	80.00 a	52.50 A
General mean for exposure period	10.00 D	27.22 C	39.44 B	48.88 A	

Similar lowercase letters in a column or row indicate that there are no significant differences, and similar uppercase letters in a column or row indicate that there are no significant differences according to Duncan's multiple range test at a probability level of 5%

The results of table (3) showed that there were significant differences in the mortality rates between the average concentrations, as the average concentration of 5000 mg / L showed the highest mortality rate, which amounted to 42.50%, followed by the concentration of 4000 mg / L, which amounted to 36.66%, while the lowest mortality rate was at the average concentration of 1000 mg / L Which amounted to 23.33%, and the average time periods after 7 days of treatment showed the highest mortality rate, which amounted to 42.22%, followed by the average time period after 5 days of treatment, which amounted to 35.55%, while the lowest mortality rate was at the time period of 1 day, which amounted to 5.55%. The overlap between the concentrations and the time periods, the overlap of the concentration 5000 mg / L after 7 days of treatment showed the highest mortality rate, which amounted to 63.33%, followed by the concentration 4000 after 7 days of treatment, which amounted to 56.66%, while the lowest mortality rate was in the concentration 1000 mg / L after 1 day From the treatment, which amounted to 0.00% in addition to the control, did not achieve any percentage of mortality the insect, the results indicate that the mechanical effect of rosemary oil works to dissolve the waxy layer of the wall of the insect's body and facilitate the task of penetration and entry of toxic active substances into the insect's body as well as its role in closing the respiratory stomata To the insect and prevent the entry of oxygen, just as rosemary oil did not give high mortaliy rates compared to if it was mixed with surface activity materials or insecticide, and the effect of rosemary oil is due to the presence of chemical compounds such as anethole, phenols and flavones, which are alkaline compounds that are highly toxic to insects, and this agrees with Abdul Rahman (2022) who indicated that the use of several types of vegetable extracts and oils in the control of insect pests has a multiple effect that may be an effect of the direct toxic method, a nutritional barrier, or a repellent

effect, and this is due to the presence of chemical compounds in those extracts and vegetable oils. The results confirmed the effectiveness of rosemary extract by using three concentrations of 15, 30, and 45%, respectively. It gave percentage mortality rates of 38.2, 43.3, and 57.6%, respectively, compared with the control, which amounted to 9.2%

Table (3) Evaluation of the effect of rosemary oil *R. officinalis* against the third instar larvae of the cotton spinyboll worm *E.insulan**a***

Concentration mg/l	**(%) Corrected mortality rate**				**General concentration mean**
	Exposure period (days)				
	1 days	**3 Days**	**5 days**	**7days**	
1000	0.00 m	20.00 j	33.33 gh	40.00 efg	23.33 D
2000	0.00 m	23.33 ij	36.66 ghf	43.33 def	25.83 D
3000	6.66 lm	30.00 hi	43.33 def	50.00 bcd	32.50 C
4000	10.00 kl	33.33 gh	46.66 cde	56.66 ab	36.66 B
5000	16.66 jk	36.66 fgh	53.33 bc	63.33 a	42.50 A
General mean for exposure period	5.55 D	23.88 C	35.55 B	42.22 A	

Similar lowercase letters in a column or row indicate that there are no significant differences, and similar uppercase letters in a column or row indicate that there are no significant differences according to Duncan's multiple range test at a probability level of 5%

The results of table (4) showed that there were significant differences in the mortality ratios between the average concentrations, as the average concentration of 1.9×10^{10} bacterial cells / ml showed the highest mortality rate, which amounted to 47.50%, followed by the concentration of 1.9×10^{9} bacterial cells / ml, which amounted to 40.00%. While the average concentration of 1.9×10^{6} bacterial cells / ml showed the lowest mortality rate, which amounted to 22.50%, and the average time periods after 7 days of treatment showed the highest mortality rate, which amounted to 45.00%, followed by the average time period after 5 days of treatment, which amounted to 37.00%. While the lowest death rate was at the time period of 1 day, which amounted to 7.77%. As for the overlap between concentrations and time periods, the overlap of concentration showed 1.9×10^{10} bacterial cells / ml after 7 days of treatment, the highest death rate, which amounted to 70.00%, followed by the same concentration after 5 days. Days of treatment, which amounted to 63.33%, while the lowest mortality rate was in the treatment of concentration 1.9×10^{6} after 1 day of treatment, which amounted to 0.00%, in addition to the control, no mortality rate was achieved for the insect, due to the effect of *B. Laterosporus* bacteria on the third stage the cotton spiny boll worm is due to the mechanism of the toxic effect of these bacteria resulting from endotoxins that invade the cells of the middle alimentary canal and eventually dissolve these cells and spread through the basal wall and fill the

visceral cavity of the larva leading to the death of the larvae as well as the deformities that appear on the insect upon transformation into The later stage, and this is consistent with what was stated by Hussan *et al*., (2022) that treating the larvae of the cotton spiny nutcracker with *B. Laterosporus* cells gave a death rate of 66.66%, while when treated with a bacterial filtrate it gave a death rate of 93.33%, and this is due to the mechanism of the toxic effect of each of Cells and toxins of *B.l* bacteria, which bind to special receptors in the cell walls of the insect's stomach, as mentioned (Berry Colin, 2011) that *B. laterosporus* is an effective biological agent against several insect pests belonging to different insect orders. It is produced in the form of new effective *Bt* insecticides. And compatible with the environment to control a group of insect pests and disease vectors, especially mosquitoes, and Al-Jubouri (2019) indicated that the mechanism of the toxic effect of the bacteria *Bacillus thuringiensis var Kurstaki* when feeding the insect on food treated with bacteria will lead to the growth and multiplication of spores inside the middle digestive tract of the insect known as the toxic protein crystals that affect On the lining of the alimentary canal and making holes in its wall, which leads to the death of the larva, as well as deformation, shrinkage, prolonged larval stage, lack of movement and immobility

Table (4) Evaluation of the effect of the vitality of *B. Laterosporus* bacteria against the third instar larvae of the cotton spiny boll worm *E.insulana*

Concentration bacterial cell/ml	**(%) Corrected mortality rate**				**General concentration mean**
	Exposure period (days)				
	1 Days	**3 Days**	**5 Days**	**7days**	
1.9×10^6	0.00 m	16.66 jkl	30.00 hi	43.33 def	22.50 E
1.9×10^7	3.33 m	23.33 ij	36.66 fgh	46.66 cde	27.50 D
1.9×10^8	10.00 l	30.00 hi	40.00 efg	50.00 c	32.50 C
1.9×10^9	13.33 kl	33.33 gh	53.33 c	60.00 b	40.00 B
1.9×10^{10}	20.00 jk	36.66 fgh	63.33 b	70.00 a	47.50 A
General mean for exposure period	7.77 D	23.33 C	37.00 B	45.00 A	

Similar lowercase letters in a column or row indicate that there are no significant differences, and similar uppercase letters in a column or row indicate that there are no significant differences according to Duncan's multiple range test at a probability level of 5%

The results of table (5) showed that there were significant differences in the mortality rates between the average concentrations, as the average concentration of 400 mg / L showed the highest mortality rate, which amounted to 57.50%, followed by the concentration of 350 mg / L, which amounted to 47.50%, while the lowest mortality rate was at the average concentration of 200 mg / L, which It reached 31.66%, and the average time periods after 7 days of treatment showed the highest

mortality rate, which amounted to 54.44%, followed by the average time period after 5 days of treatment, which amounted to 43.33%, while the lowest killing rate was at the time period of 1 day, which amounted to 13.33%. Between concentrations and time periods, the overlap of the concentration 400 mg / L after 7 days of treatment showed the highest mortality rate, which amounted to 90.00%, followed by the concentration of 350 mg / L after 7 days of treatment, which amounted to 73.33%, while the lowest mortality rate was in the concentration 200 mg / L after 1 day of treatment, which amounted to 6.66%, in addition to the control, did not achieve any mortality rate for the insect. The interpretation of the results is attributed to the process of mixing Decise pesticide with the bacteria *B. Laterosporus*, which gave compatibility and a high mortality rate against the larvae of the third age of the cotton spiny boll worm, and this is due to the occurrence of The process of activating the bacteria as a result of the presence of compounds and elements in the pesticide, which the bacteria benefit from for feeding, which increases reproduction and penetration within the insect's body. The mechanism of the effect of the pesticide has an important role in paralysis of the insect, which facilitates the entry and spread of bacteria and the occurrence of greater toxicity towards the treated insect this is similar to Taqi (2007) The treatment of Avaunt150sc and the two treatments of mixing it with bacteria inhibited highly effective hatching of eggs in the greater wax worm and caused 100% mortality of all larval instars, but the late larval instars (from the fourth to the seventh) showed less sensitivity compared to the larval instars. the first three, the Avaunt150sc pesticide treatment and the commercial preparation Certan alone achieved a 100% mortality rate in the wax worm pupae, and the adults emerging from the treated pupae were all deformed and did not lay a single egg. The cotton spiny boll worm, *E. insulana*, to yield when used with one or two sprays during the season, and it was found that the pesticides Cypermethrin, Comodor, Hostathion, growth regulator Match, and biocide Agreen were superior when using one spray during the season. The percentage of loss in cotton yield was (27.4, 30.8 , 32.8, 35.3, 37.6%), respectively, outperformed Cypermethrin, and when used with one spray at the stage of bud formation and the second at the stage of flowering and nut formation, this led to a significant reduction in the percentage of loss in the yield components compared to when used with one spray, as the percentage reached Percentage loss in cotton yield (15.4, 18.2, 19.6, 21.5, 24.3%

Table (5) Evaluation of the effect of Decise on *B. laterosporus* at a concentration of 1.9×10^{10} bacterial cells/ml against the 3rd larval instar of the cotton spiny boll worm *E.insulana*

Concentration mg/l	(%) Corrected mortality rate				General concentration mean
	Exposure period (days)				
	1 days	3 Days	5 days	7 days	
200	6.66 kl	30.00 hi	40.00 f	50.00 e	31.66 E
250	10.00 k	33.33 gh	43.33 f	53.33 de	35.00 D
300	16.66 j	36.66 fg	50.00 e	60.00 c	40.83 C
350	20.00 j	40.00 f	56.66 cd	73.33 b	47.50 B
400	26.66 I	43.33 f	70.00 b	90.00 a	57.50 A
General mean for exposure period	13.33 D	30.55 C	43.33 B	54.44 A	

Similar lowercase letters in a column or row indicate that there are no significant differences, and similar uppercase letters in a column or row indicate that there are no significant differences according to Duncan's multiple range test at a probability level of 5%

The results of table (6) showed that there were significant differences in the mortality rates between the average concentrations, as the average concentration of 5000 mg / L showed the highest mortality rate, which amounted to 50.83%, followed by the concentration of 4000 mg / L, which amounted to 42.50%, while the lowest mortality rate was at the average concentration of 1000 mg / L which amounted to 26.66%, and the average time periods after 7 days of treatment showed the highest mortality rate, which amounted to 47.77%, followed by the average time period after 5 days of treatment, which amounted to 40.55%, while the lowest mortality rate was at the time period of 1 day, which amounted to 7.77%. The overlap between concentrations and time periods, the overlapping concentration showed 5000 mg / L after 7 days of treatment, the highest mortality rate, which amounted to 76.66%, followed by the same concentration after 5 days of treatment, which amounted to 66.66%, while the lowest mortality rate was in the concentration 1000 mg / L after 1 day From the treatment, which amounted to 0.00% in addition to the control, it did not achieve any percentage of mortality the insect, the results indicated that the process of mixing rosemary oil with the bacteria *B. Laterosporus* is due to the synergistic process between the oil and the bacteria, as the oil works to close the respiratory stomata and suffocation of the insect as well as the effect of chemical compounds Existing in the oil, which works to inhibit the enzyme acetylcholine esterase and thus facilitate the process of bacteria multiplication inside the body of the insect without exposure to a defensive process in the insect as the protein crystals are linked in the receptors of the wall of the insect's stomach, which causes a hole in it and then to the

body cavity and causes poisoning, then paralysis and death. The factor of time and duration of exposure works to multiply and activate bacteria, and this converges with the results of Al-Rafi'i (2018) that the results of the effect of mixtures of Spintor (Bt) with castor oil had an average mortality rate of 82.50%, followed by the treatments of the combinations (Spintor + neem oil) and (Spintor + extract). oleoresin) and (Belitherol + castor oil) with a mortality rate of 79.17, 78.33 and 77.5%, respectively

Table (6) Evaluation of the effect of *R. officinalis* rosemary oil with *B. Laterosporus* at a concentration of 1.9×10^{10} bacterial cells/ml against the 3rd larval instar *of E.insulana*

Concentration mg/l	(%) Corrected mortality rate				General concentration mean
	Exposure period (days)				
	1 days	3Days	5 days	7 days	
1000	0.00 i	23.33 j	36.66 hi	46.66 efg	26.66 E
2000	3.33 i	30.00 I	40.00 gh	50.00 def	30.83 D
3000	10.00 k	36.66 hi	43.33 fgh	53.33 cde	35.83 C
4000	13.33 k	40.00 gh	56.66 cd	60.00 c	42.50 B
5000	20.00 j	40.00 gh	66.66 c	76.66 a	50.83 A
General mean for exposure period	7.77 D	28.33 C	40.55 B	47.77 A	

Similar lowercase letters in a column or row indicate that there are no significant differences, and similar uppercase letters in a column or row indicate that there are no significant differences according to Duncan's multiple range test at a probability level of 5%

The results of table (7) showed that there were significant differences in the mortality rates between the average concentrations, as the average concentration of 400 mg / L showed the highest mortality rate, which amounted to 61.66%, followed by the concentration of 350 mg / L, which amounted to 52.50%, while the lowest mortality rate was at the average concentration of 200 mg / L, which It reached 36.66%, and the averages of the time periods after 7 days of treatment showed the highest mortality rate, which amounted to 58.33%, followed by the average time period after 5 days of treatment, which amounted to 48.33%, while the lowest mortality rate was at the time period of 1 day, which amounted to 16.11%. Between concentrations and time periods, the overlap of the concentration 400 mg / L after 7 days of treatment showed the highest mortality rate, which amounted to 93.33%, followed by the concentration of 350 mg / L after 7 days of treatment, which amounted to 76.66%, while the lowest mortality rate was in the concentration 200 mg / L after 1 day of the treatment, which amounted to 10.00%, in addition to the control, did not achieve any percentage of killing the insect, and the results indicated that the

process of mixing the Decise insecticide with rosemary oil gave a synergistic activation of the insecticide, which caused a higher mortality process against the treated insect as a result of the inhibition of some enzymes present in the insect And responsible for metabolizing the pesticide and that the oil covers the respiratory openings in the wall of the body, which leads to paralysis of the insect, and the effect of Decise insecticide prevents the conduction of nerve signals in the nervous system of the insect, and this results in a prolonged permeability of the nerve to the sodium element, which leads to a series of repeated nerve signals in the sensory organs and nerves sensory organs and muscles, which leads to the death of the treated insect, and this is confirmed by Karso, (2012); Al-Baldawy (2022) that the stimulatory effect shown by vegetable oils in some pesticides is due to synergism, the activating effect more than due to potentintion, the toxic effect, as a result of the polarity of these oils, which facilitates the process of penetration of the pesticide through the dissolution of the waxy layer and penetration of the body wall to reach the sites effect mortality, in addition to the ability of some oils to inhibit enzymatic systems in the insect's body and thus prevent it from metabolizing the pesticide as well as the effect of the density and viscosity of vegetable oils, as indicated by Jabbar and Muhammad (2014) that the use of chemical control with Prochlaim insecticide and Neem oil in the control of Tuta leaf miner absoluta, and the results were mortality rates of 88.3 and 85.16%, respectively. *B.thuringiensis* and *Trinhoderma harzianum* preparations were also used, and their effect did not appear beyond the third day of treatment. It was found that the highest mortality percentage after the 14th day of treatment for all pesticides was 66.8 and 61.2. %, respectively, in field control, Prochlaim and Neem oil recorded the highest percentage of mortality of larvae, reaching 72.82 and 68.78%, respectively. It was noted that the highest percentage of mortality after 14 days of treatment with insecticides was 47.92% .

Table (7) Evaluation of the effect of Decise with rosemary *R. officinalis* at a concentration of 5000 mg/L against the 3rd larval instar of the cotton spiny boll worm *E.insulana*

Concentration mg/l	**(%) Corrected mortality rate**				**General concentration mean**
	Exposure period (days)				
	1 days	**3 Days**	**5 days**	**7 days**	
200	10.00 q	33.33 lm	46.66 hij	56.66 efg	36.66 D
250	13.33 pq	36.66 klm	50.00 ghi	60.00 fgh	40.00 D
300	20.00 p	40.00 jkl	53.33 fgh	63.33 de	44.16 C
350	23.33 no	43.33 ijk	66.66 ed	76.66 b	52.50 B
400	30.00 mn	50.00 ghi	73.33 bc	93.33 a	61.66 A
General mean for exposure period	16.11 D	33.88 C	48.33 B	58.33 A	

Similar lowercase letters in a column or row indicate that there are no significant differences, and similar uppercase letters in a column or row indicate that there are no significant differences according to Duncan's multiple range test at a probability level of 5%

CONCLUSION

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