



Compar the Effectiveness of Some Plant Extracts and Nd: YAG Laser in the Tribolium castaneum

Estabraq Mhmood Mahdi , Saeed Maher Lafta, Rashed Ismail Taha

Department of Biology , College of Science , Tikrit University , Tikrit , Iraq

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Corresponding Author:

Name: Estabraq Mhmood Mahdi

E-mail:

Abk_mm@yahoo.com

Tel:

Abstract

The present study was conducted to evaluate the efficiency and effectiveness of some plant extracts of *Helianthus annuus* L., *Sesbania sesban* and *Olea europea* concentrations 100, 500, 1000, 5000 ppm. and the effect of Nd: YAG laser with wavelength of (1064nm) and different energies which conducted at (10,15 and 20) within (5 pulses/sec) to destruction of the *Tribolium castaneum*, the study found different results according to the different concentrations used, time period and the different energies of the laser during the treatment. Treatment with plant extracts The extract of the *Helianthus annuus* L. was hightst to the rest of the plant extracts. It gave a 100% mortality rate at 5000 ppm concentration 72 hours of treatment. Then the seesban seed extract came in terms of effect, giving 96.6% mortality rate at the same concentration after 72 hours. While the effect of *Olea europea* extract was the last impact"on the insect, where the rate of mortality 86.5% in the same concentration also and within (72 hours) of treatment.

The results showed that the effect of laser radiation on the life of the insect, where it gave the highest mortality rate 73.6% when irradiation at the highest power of 420mj and exposure time 20Sec. the results were obtained after observation of the effect of plant extracts and Nd : YAG at different time intervals 24, 48 hours and 72 hours after the treatment of the *Tribolium castaneum* .

Introduction

Recently the plant extracts used to control insects, crop pits and stored grains as alternatives to chemical pesticides, which have desirable characteristics and are not available in the groups of organic pesticides, have been directed at the rapid elimination of their high sensitivity to light, heat and humidity. And changes into low toxicity for human and animal life [1].

The insects of the stores contributed to the destruction of food products through their presence on the food material, as well as insect products such as chemical secretions, dead insects and the exposure of humans to dangerous chemicals materials due to the control of these insects [2].

The subject of life physics has many disciplines, which include the fields of biology, physics, computational biology and others in microbes, plants, animals and humans, the contributions of scientists and experts includes different continents and countries on the main aspects of life physics, which

led to the development of all technologies and applications in this field [3].

The laser is one of the most important techniques in this field for its wide applications in the field of industrial, medical, biological, economic and agricultural [4].

The interaction of the laser with the biological tissue has a local effect, and all the energy of the radiation can be given to the location of the exposed tissue and target. The process of interaction between the laser beams and the biological tissue and the effect generated by the interaction depend on the characteristics of the laser beam used and the tissue [5]. When the lasers are shed, the energy is absorbed into a heat that absorbs the processed tissue. Part of it is evaporated and evaporated by evaporation of the water content in the cells. The remaining part is transferred to the surrounding tissue where it is heated. This creates the unwanted thermal effect in the neighboring tissues[6].

In this study was used in irradiation to influence the beetle to note its effect on the biological impact on the life of this insect and compare with Some plant extracts used in this study.

Materials and methods

- Collection of samples:

The adult insects of the *Tribolium castaneum* beetle were collected from the infected flour and kept at 25 ° C in the laboratory of parasites and insects of the biology Department at the college of Science / University of Tikrit[7].

- Breeding the insect:

The insect was taken from the insect-infested flour from one of the markets in Al- Dour city. The insect was adopted on whole wheat flour, which contains a high percentage of bran. The laboratory culture were prepared with 10 clean and sterile glass bottles. (10 gm / bottle) of flour were placed in , and then(10 pairs) were placed for each one bottles, and the bottles were covered with apiece of gauze and the nozzle of bottle was sealed with belts of made rubber material. And then placed into the incubator at 30 ° C and relative humidity (\pm 70%) .

Plants collection and preparation of plant extracts:

The plant samples of *annuus* L., *Sesbania sesban* and *Olea europea* were collected from the local markets of Al – Dour city. The selected plant parts were cleaned from the suspended dust. Which placed on special paper and at room temperature for drying and grind by the electric grinder. To get powder, the vegetable powder of the seeds was stored in clean and dry plastic containers to the extraction process, the extracts were prepared by the Soxhlet apparatus or the continuous extractor [8]. At the college of Agriculture Laboratory, Tikrit University, the seeds and fruits of the plants used in the present study were grinded by electric grinder and took(100 g) of sunflower seed powder, sisaban and olive fruits separately and placed in a thimble filter paper with a(500 ml) flask.(250 ml) of petroleum ether was placed at 95% concentration. In 48 hours, at 55-60 ° C. After extraction, the extract was concentrated in the vacuum rotary evaporator at the Central Laboratory of Research at the University of Tikrit and at a temperature of 55-60 ° C for disposal of residual solvent to obtain a fluid that is heavy in strength, repeat the process dozens of times until the heat to get the concentrated extract, the extract is then placed in dark glass bottles and stored in the fridge until use.

Preparation of extract concentrations:

The required concentrations were obtained by taking 1 g of seed extract and fruit for each of these plants and placing each in a glass container 100 ml adding 99 ml of distilled water. The twin 80 (polysorbate) was added to the mixture (distilled water and extract) until the mixture is suspended in an easy way. Spread, and thus obtain a 1% concentration solution or 10000 ppm, according to the dilution formula of $C1V1 = C2V2$. The other concentrations required of (100, 500, 1000,5000) per million were prepared for

the required plant extracts but control is distilled water only.

Laser irradiation:

The Nd: YAG laser was used with a wavelength (1064 nm) to irradiate the adults of insect were collected and reared to observe the effect of changing the laser parameters by changing the time period for exposing to laser radiation and stabilizing the distance between them with the laser source. The samples were divided into 15 groups, and offered for radiation.

Five groups of insects were taken and the distance between five group and the laser source was determined to be 20 cm. with fixing the irradiation time for this group. The group was irradiated for 10 sec and five different capacities were (260, 300, 340, 380 ,420) mJ.

Then the other five groups were in the same distance with the irradiation time to 15 sec, with the same energies above. Then the last five groups were irradiated at the same distance with changing the irradiation time to be 20 sec.

The mortality percentages of adult per group were calculated after 24, 48, 72 hours and then compared results of adults mortality percentages by plant extracts used in the study.

Statistical analysis:

The results were statistically analyzed by using (ANOVA) analysis of variance, and then a multimodal Dunkin test was performed at a 5% probability level to confirm that there were significant differences between the different parameters [9].

Results & Discussion

1- The efficacy of plant extracts in *Tribolium castaneum* after 24 hours of treatment.

The results of table (1) shows the mortality percentage of insects by plant extracts after 24 hours of the treatment of the serotonin flour beetle. the concentrations 100, 500, 1000, 5000 ppm, where the results showed that there is an effect for all the plant extracts used in the death of adults.

The results of the statistical analysis showed in figure (1) that there are significant differences in the toxicity of the plant extracts according the type of plant extract used. It was observed that the mortality percentage increase with increasing concentration and that there is a difference between the plants in the occurrence of the deadly effect so that the plant extract exceed to another , In the quality and quantity of the active compounds that are contained in different plants which affect in the nervous system of the insect, which paralyzes the movement leading to shock and death, as well as the impact on the work of enzymes necessary for the vital processes, which lead to the cessation of metabolism and thus Death [10].

The results of the table (1) showed that the extract of the seeds of the *Helianthus annuus* L. gave the highest effect in mortality from the rest of the plant

extracts. The highest mortality percentage was 50% in the concentration of 5000 ppm and the lowest mortality percentage was 30% at 100ppm concentration after 24 hours of treatment the result showed. Flour beetle is very sensitive to plant extracts, where the results showed a positive relationship between the mortality percentage and concentration, the increasing of concentration leads to increase percentage of killing . The exposure of flour beetle to extracts leads to ability to move legs, wings and feed. This is due to that the plant extracts have a highly toxic effect that effects on the nervous system significantly[11].

The results showed that the extract of seesban seeds follows the extract of the *Helianthus annuus* L. in terms of its effect on the flour beetle. The highest mortality percentage was 43.3% at the concentration of 5000 ppm and the lowest mortality percentage was 26.6% at 100 ppm concentration after 24 hours of treatment as shown in Table(1).

While the results showed that the extract of olive fruits was the lowest plant extracts impact on the insect compared to the rest extracts with the highest mortality percentage 33.3% in the concentration of 5000 ppm and the lowest mortality percentage of 13.3% in the concentration of 100 ppm, compatibles with these results [12]. Which showed that the extract of datura fruits was the lowest efficacy in the. *Callosobruchus maculatus* F. Where the highest mortality percentage was 50.00% at 10000 ppm concentration after 24 hours of treatment, As shown in Figure (1).

2- The efficacy of plant extracts in *Tribolium castaneum* after 48 hours of treatment.

The results shown in Table (1) showed that the treatment of the flour beetle after 48 hours increased their lethal concentration, where the percentage of killing of *elianthus annuus* L. seeds extract increased compared to mortality percentage after 24 hours of treatment due to the duration of exposure, where the increasing the duration of effective factor increased the mortality percentage, as gave the *Helianthus annuus* L. extract gave the highest mortality percentage of 80% at the concentration of 5000 ppm after 48 hours of treatment.

The results confirmed in table (1) that the effect of the extract of seesban seeds comes after the seeds of

the *Helianthus annuus* L. extract through its effect on the adult. the highest mortality percentage 70% at the concentration 5000 ppm and the lowest mortality percentage 30% at 100 ppm concentration, figure(1).

The results showed that the olive extract was the lowest of the extracts compared with the rest of the extracts. The effect on the insect increased after 48 hours compared with its effect after 24 hours. The mortality percentage were 20, 55.5% in the concentrations of 100 and 5000 ppm respectively after 48 hours of treatment.

3- The efficacy of plant extracts in *Tribolium castaneum* after 72 hours of treatment.

The results recorded that highest mortality percentage of the *Tribolium castaneum* as indicated in Table (1) when treated with sunflower seed extract after 72 of the treatment. The results gave a killing rate of 70-100% at the concentrations of 100 and 5000 pmm respectively, the increasing of mortality percentage is due to the effect of active or toxic substances in the plant extract has increased by increasing the percentage of concentrations used, which affected the digestive tract or nervous system of the insect and thus lead death.

The results indicated in Table (1) that the extract of the seeds of sisaban came after the extract of the sun flower in terms of its effect on the flour beetle, the highest rate of killing 96.6% in the concentration of 5000 ppm and the lowest mortality percentage of 66.6% in the concentration of 100 ppm within 72 hours of treatment.

The results indicated that the olive extract was the least effective compared to the other extracts. The mortality percentage were 66.6 and 86.5% in the concentrations of 100 and 5000 ppm respectively after 72 hours of treatment. The effect of this extract gave high mortality percentage after 72 hours compared with its effect within 24 and 48 hours of treatment , As shown in Figure (1).

Thus, this study compatible with the study [13]. noting that the rate of insect death increases as the exposure time of the plant extract increases. Also, the results were corresponding to the study [14]. which showed that the mortality percentage of *Trogoderma granarium* has increased when treated with the extract of tubers *cyperus* plant with increased exposure time.

Table (1) Mortality Percentage of *Tribolium castaneum* treated with plant extracts

Average plant	Average concentration	time / Mortality Percentage hours			Concentration ppm	extracts
		72	48	24		
56.9 A	44.4 C	70.0 C	33.3 f	30.0 f	100	Seeds of <i>Helianthus annuus</i> L.
	50.9 BC	73.3 C	43.3 e	36.2 f	500	
	64.6 A	96.6 A	53.8 d	43.3 e	1000	
	67.9 A	100 A	80.0 b	50.0 d	5000	
		85.0 aA	52.6 bA	39.8 cA	Average time in the seeds of the sun flower	
51.3 A	41.1 CD	66.6 C	30.0 ef	26.6 f	100	Seeds of <i>Sesbania sesban</i>
	44.4 C	70.0 C	33.3 de	30.0 ef	500	
	49.9 B	83.3 B	36.6 de	30.0 ef	1000	
	69.9 A	96.6 A	70.0 c	34.3 d	5000	
		79.3 aA	42.5 bAB	32.5 cAB	Average time in sesban seeds	
41.5 B	33.3 DE	66.6 B	20.0 fg	13.3 g	100	fruits of <i>Olea europea</i>
	28.9 E	66.6 B	26.6 ef	20.0 fg	500	
	45.5 C	80.0 A	30.0 de	26.6 ef	1000	
	58.4 AB	86.5 A	55.5 c	33.3 d	5000	
		74.9 aA	42.7 b	23.3 bB	Average time in olive fruits	
		79.8 A	42.7 b	31.9 c	Average overall time	

*Similar small letters in one line (horizontally) mean no significant differences.

**Similar capital letters in one column (vertically) mean no significant differences.
(Using Dankin test)

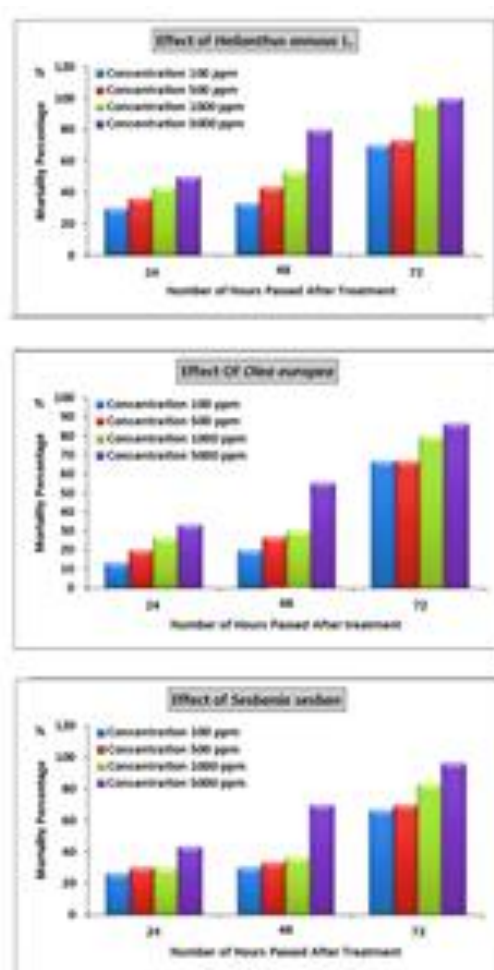


Figure (1) Mortality Percentage of *Tribolium castaneum* treated with plant extracts.

2- Effect of laser Nd: YAG on the life of Flour Beetle.

- The mortality percentages of *Tribolium castaneum* after (24, 48, 72) hours of treatment with irradiation period (10 sec).

The percentages indicated in Table (2) show that there are significant differences in the effect of laser on the flour beetle life being irradiated at of (10 sec), with the distance of 15 cm. The results gave the highest mortality percentage of death at laser irradiation at energy 420 mJ. The mortality percentage

was 18.5% after 24 hours of the treatment. The results also showed the lowest mortality percentage in the treatment was laser and the same distance and energy 260 mJ. The mortality percentage was 10.0%. through the results in the table . it can be seen thus the ratios increase by increasing the duration of exposure and energy. and the highest mortality percentage were after 48 and 72 hours of treatment, 23.3% at energy 420 mJ, and through The results showed that the mortality percentage of the insect increased by increasing the radiation energy as shown in Figure (2).

- The mortality percentages of *Tribolium castaneum* after (24, 48, 72) hours of treatment with irradiation period (15 sec).

The results of Table (2) showed that the mortality percentage of the insect after 24, 48 and 72 hours and the irradiation period 15 sec of laser treatment increased compared to the results of treatment with irradiation period (10 sec). the results gave the highest mortality percentage at laser irradiation at energy 420 mJ. The mortality percentage was 60.7% after 72 hours of treatment, while the results gave the lowest mortality percentage 26.7% after 24 hours of treatment. As shown in Figure (2) . the mortality percentage increased by increasing the exposure time of radiation. As well as the period of time to calculate the mortality percentage and increasing the energy of radiation.

- The mortality percentages of *Tribolium castaneum* after (24, 48, 72) hours of treatment with irradiation period (20 sec).

The results shown in Table (2) recorded that there are significant differences in the effect of laser on the flour beetle, where it was observed that the mortality percentage increased with increasing irradiation and laser energy used in the study. In figure (2) the irradiation 20sec and energy 420 mJ gave the highest effect on the insect the highest mortality percentage 84.5% during 72 hours of treatment and lowest mortality percentage is 43.3% after 24 hours of the treatment. Thus the results showed that the exposure period of irradiation at 20 sec as compared to the rest of the periods in this study.

Table (2) Mortality Percentage of *Tribolium castaneum* treated with plant extracts

Average time (sec)	Average energy (mj)	Mortality Percentage hours / time			Energy (mj)	Exposure time(sec)
		72	48	24		
21.0 C	16.7 G	23.3 cd	16.7 ef	10.0 g	260	10
	20.0 FG	26.7 bc	20.0 de	13.3 fg	300	
	20.0 FG	26.7 bc	20.0 de	13.3 fg	340	
	23.4 F	30.3 ab	23.3 cd	16.7 ef	380	
	25.0 F	33.3 a	23.3 cd	18.5 def	420	
		28.1 aC	20.7 bC	14.4 cC	Average time in (10 sec)	
44.8 B	35.6 E	43.3 c	36.7 d	26.7 e	260	15
	37.8 E	50.5 b	36.7 d	26.7 e	300	
	45.6 D	50.5 b	50.0 b	36.7 d	340	
	49.6 CD	55.5 ab	50.5 b	43.3 c	380	
	55.4 C	60.7 a	55.5 ab	50.0 b	420	
		79.3 aA	42.5 bAB	32.5 cAB	Average time in (15 sec)	
62.3 A	51.1 C	66.7 cd	43.3 h	43.3 h	260	20
	53.3 C	66.7 cd	50.0 g	43.3 h	300	
	63.3 B	73.8 b	60.7 ef	55.5 fg	340	
	70.2 A	80.0 a	70.0 bc	60.7 ef	380	
	73.6 A	83.3 a	73.8 b	63.7 de	420	
		84.5 aA	59.6 bA	53.3 bA	Average time in (20sec)	
		54.8 a	42.0 b	34.8 c	Average overall time	

*Similar small letters in one line (horizontally) mean no significant differences.

**Similar capital letters in one column (vertically) mean no significant differences. (Using Dankin test)

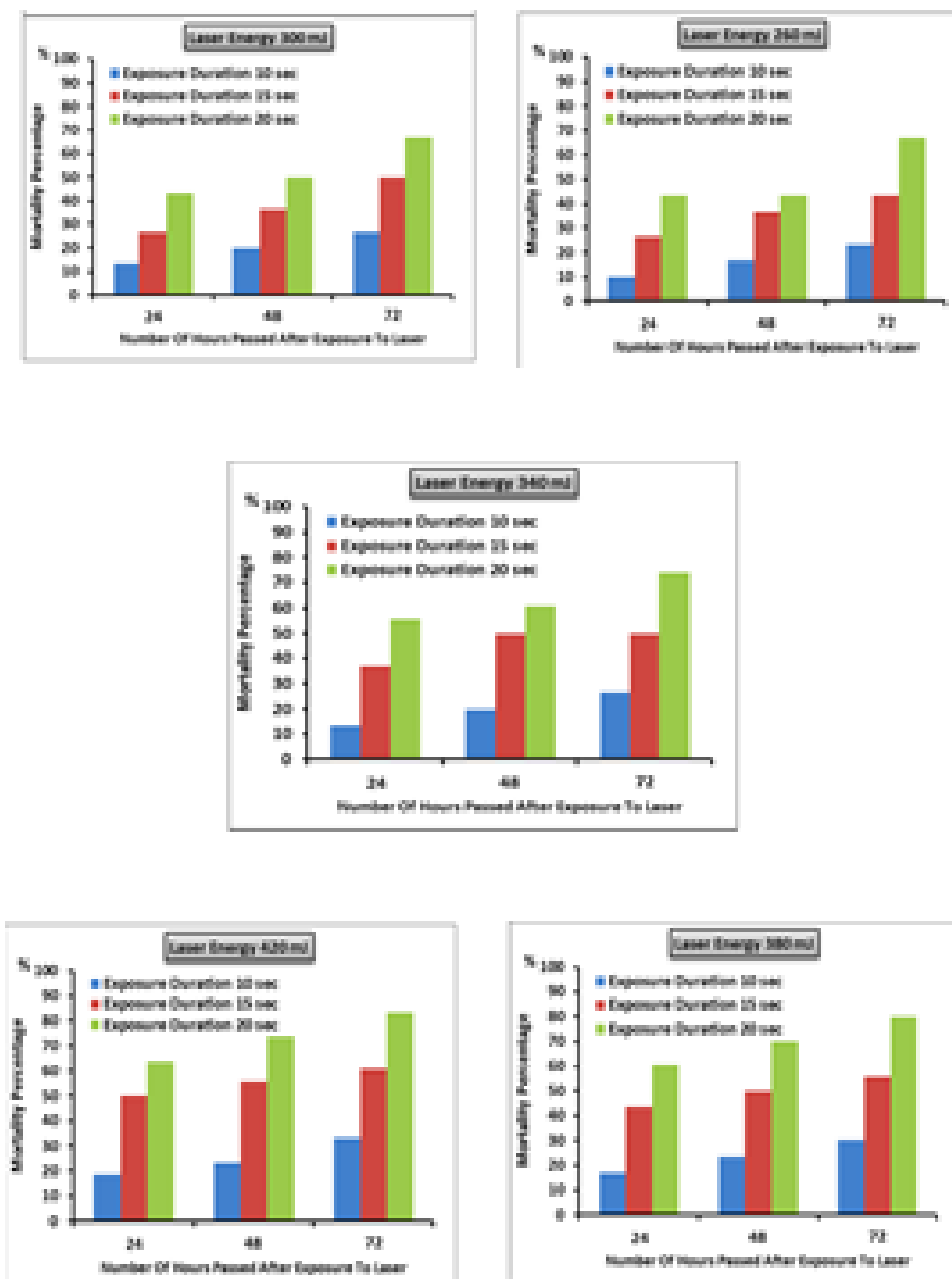


Figure (2) Mortality Percentage of *Tribolium castaneum* treated with laser Nd:YAG.

Conclusion

The study concludes that the plant extracts can be used as an alternative to chemical pesticides due to the results obtained during the control because containing on oils and active substances that have the ability to effect insects and cause their death. This is a safe and effective alternative to other substances. The

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lasers has a significant impact on the death and control the insect but it was low effect from the plant extracts. This depending on the working conditions and experiments conducted during this study. It was observed that there is a positive relationship between the duration of exposure and mortality percentage, as well the type of plant extract with concentration.

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امقارنة فاعلية بعض المستخلصات النباتية و ليزر نديميوم ياك Nd : YAG في خنفساء الطحين

Tribolium castaneum الصدئية

إستبرق محمود مهدي ، سعيد ماهر لفتة ، راشد اسماعيل طه

قسم علوم الحياة ، كلية العلوم ، جامعة تكريت ، تكريت ، العراق

الملخص

اجريت هذه الدراسة لتقييم كفاءة و فاعلية بعض المستخلصات النباتية لنباتات زهرة الشمس *Helianthus annuus* L. والسيبان *Sesbania sesban* والزيتون *Olea europea* عند التراكيز 100 ، 500 ، 1000 ، 5000 ppm . تأثير ليزر نديميوم ياك Nd : YAG بطول موجي (1064nm) وطاقات مختلفة والذي اجري على مسافة 20 cm وبفترات تعرض زمنية لأشعة الليزر (10,15, 20) sec وبمعدل (5 نبضة / ثانية) في هلاك كاملات خنفساء الطحين الصدئية *Tribolium castaneum* ، توصلت دراستنا إلى نتائج مختلفة باختلاف التراكيز المستخدمة والمدة الزمنية وباختلاف الطاقات بالنسبة لليزر اثناء للمعاملة، حيث أظهرت المعاملة بالمستخلصات النباتية تفوق مستخلص زهرة الشمس على باقي المستخلصات النباتية، اذ أعطى نسبة قتل 100% عند التركيز 5000 ppm بعد 72 ساعة من المعاملة، ثم يأتي مستخلص بذور السيبان من حيث التأثير اذ أعطى نسبة قتل 96.6% عند نفس التركيز خلال 72 ساعة، بينما كان مستخلص ثمار الزيتون هو الأقل تأثيراً على الحشرة حيث حقق نسبة قتل 86.5% في نفس التركيز أيضاً وخلال 72 ساعة من المعاملة. كما أظهرت النتائج ان هناك تأثيراً لأشعة الليزر على حياة الحشرة حيث أعطت أعلى نسبة للقتل 73.6 عند تشيع الكاملات بأعلى طاقة وهي 420 mj و بزمن تعريض 20Sec.

وتم الحصول على النتائج في هذه الدراسة بعد ملاحظة تأثير المستخلصات النباتية وليزر نديميوم ياك على مراحل زمنية مختلفة أي بعد مرور (24 ساعة) ثم بعد (48 ساعة) و (72 ساعة) من معاملة حشرة خنفساء الطحين الصدئية .