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EFFICIENCY OF CERTAIN INSECTICIDES & BIO-PRODUCTS AGAINST *BEMISIA TABACI* (GENN.) AND *TETRANYCHUS URTICAE* KOCH ON POTATO PLANTS UNDER FIELD CONDITIONS AT QALUBIA GOVERNRAT, EGYPT

[45]

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ABSTRACT

A field experiment was conducted during autumn plantation in season 2017 at Qaha, Qalubiya Governorate to evaluate the efficiency of ten different control agents; four of them are biorational components (garlic extract, rosemary oil + sunflower oil, sesame oil and chili oil), three of them are natural pesticide (Techno Oil, Top9 and Berna Star), one agent of them is bio-pesticide (bio-fly) and two chemical pesticide (Blanch 48% SC, Mospilan 20% SP) in reducing the population densities of *Bemisia tabaci* and *Tetranychus urticae* on Hatma potato cultivar. The results indicated that there were significant differences between the ten tested compounds in reducing the population density of *B. tabaci* nymphs; Mospilan 20% SP was the most potent compounds in reducing the population density of *B. tabaci* nymphs causing the highest reduction percentage (83.58 %), while Top9 gave a low effect with reduction percentage (49.32%) and Bio-fly gave moderate reduction percentage (63.92%). These compounds could be divided into two groups according to the reduction percentage: 1st group contains Mospilan 20% SP, Blanch 48% SC (chemical pesticides), Berna Star and Techno Oil (natural pesticides), respectively. 2nd group contains on Bio-fly (bio-pesticide), sesame oil, garlic extract, chili oil, rosemary oil + sunflower oil (biorational components), and Top9 (natural pesticide) on *B. tabaci* nymphs. Results also revealed that there were significant differences between the mean of general reduction percentage of the ten tested compounds on *T. urticae* population. Mospilan 20% SP recorded the highest reduction percentage (73.1 %), (rosemary oil + sunflower oil) treatment recorded the lowest reduction percentage 41.97% and Top9 gave moderate reduction percentage (60.03%). These compounds could be divided into two groups: 1st group contains on Mospilan 20% SP, Techno Oil, Blanch 48% SC, garlic extract, Top9, chili oil, sesame oil and Berna Star respectively. 2nd group contains on Bio-fly and (rosemary oil + sunflower oil) respectively.

Keywords: *Bemisia tabaci, Tetranychus urticae*, potato, insecticides, plant extract, plant oils.

INTRODUCTION

Potato, (*Solanum tuberosum* L.) is one of the economically important vegetable crops belong to family: Solanaceae all over the world and it has spread in many countries with warmer and drier climates **(Beukama and Eanderzaag, 1990)**. Potato is considered the second most important vegetable crop grown in Egypt for local consumption, export and processing and the manufacturing of some food industries **(Omar et al 2015)**.

Miresmailli and Isman (2006) in Canada noted that pure rosemary oil and EcoTrol pesticide containing rosemary) caused complete mortality of spider mites *Tetranychus urticae* at concentrations that are not phytotoxic to the host plant. **Erdogan et al (2012)** in Turkey, studied the efficacy of five plant extracts included *Allium sativum* L. (Amaryllidaceae) against *Tetranychus urticae* Koch. They observed that the capability of adult mites to lay eggs

was decreased even in the lowest concentrations compared to the control. **Iram et al (2014)** in Pakistan, studied the effect of some plant extracts and some vegetable oils such as peppermint (*Mentha* spp.), Geranium (*Pelargonium graveolens*), soybean oil (*Glycine max*), mustard oil (*Brassica* spp.), Taramera oil (*Eruca sativa*) against *Bemisia tabaci*. They reported that the whitefly population was significantly suppressed by both the vegetable oils and extracts as compared to the control treatment. On the other hand, vegetable oils significant results as compared to plant extracts. **Fatima et al (2015)** in Zimbabwe, approved that the red chili and garlic extracts were effective in controlling red spider mites leading to decreased infestation, increased growth, and high yield of tomatoes. **El-Fakharany et al (2016)** in Egypt**,** studied that the efficiencies of certain compounds; Warnt (imidacloprid), Twistrid (acetamipirid), garlic oil, Kz oil, and eucalyptus oil in reducing the population density of *Bemisia tabaci*.; they referred that the Twistrid showed a high efficiency in reducing *B. tabaci* and Garlic oil showed the lowest efficiency. **Hussein (2017)** in Egypt, evaluated the repellency and oviposition preventions of three plant oils; cumin (*Cuminum cyminum*), thyme (*Thymus vulgaris*), and garlic (*Allium sativum*) against whitefly; *Bemisia tabaci*. He confirmed that the thyme oil treatment caused the highest repellency and anti-oviposition, followed by garlic oil. The effect on survival of larvae was observed with garlic oil, while the greatest effect on immature stages was occurred with thyme oil. Eggs and pupae were less sensitive to plant oil treatments, compared with *Bemisia tabaci* nymph.

The objective of this study was to evaluate the efficiency of ten different control agents; four of them are biorational components (garlic extract, rosemary oil + sunflower oil, sesame oil and chili oil), three of them are natural pesticide (Techno Oil, Top9 and Berna Star), one agent of them is bio-pesticide (bio-fly) and two chemical pesticide (Blanch 48% SC, Mospilan 20% SP) in reducing the population densities of *Bemisia tabaci* and *Tetranychus urticae* on Hatma potato cultivar.

MATERIALS AND METHODS

A field experiment was carried out during autumn plantation in season 2017 at Qaha, Qalubiya Governorate. This experiment was designed to evaluate the efficacy of ten control agents including Mospilan 20% SP compound as a standard pesticide on the population of two main pests; *Bemisia tabaci* and *Tetranychus urticae*; infesting potato plant cultivar Hatma **(Table 1)**.

Table 1. Insecticides & bio-products applied against *Bemisia tabaci* and *Tetranychus urticae* on potato plants at Qaha Qalubiya governorate Egypt.

NO.	Trade Name	Common Name	Rate / 20 L Water
1	Garlic extract	Plant extract	200 g
2	Rosemary oil + sunflower oil	Vegetable oil	20cm+10 cm^3
3	Sesame oil	Vegetable oil	30 cm^3
4	Chili oil	Vegetable oil	30 cm^3
5	Techno Oil	Vegetable oil	40 cm^3
6	Top9	Naphthyl acetic acid (NAA) + Chitin (Chitosan)	75 cm^3
7	Blanch 48% SC	Thiacloprid	6 cm^3
8	Mospilan 20% SP	Acetamiprid	5 gm.
9	Berna Star	Plant extract (Coconut fruit core + Avocado fruit seed)	160 cm^3
10	Bio-fly	Spores of fungus ; *Beauveria bassiana*	50 cm^3

Experiment design

The area of this experiment was about 260 m^2, divided into 33 plots (each treatment replicated 3 times) for 10 treatments in addition to the control. Treatments of compound used arranged in a complete randomized block design. A Knapsack sprayer (20 litters) was used, filled with that prepared concentration just before each treatment. Thirty leaflets were picked randomly from each treatment (10 leaflets /replicate) representing the plant levels. Samples were put in paper bags and transferred to the laboratory and examined by the stereomicroscope. Inspection of plants was carried out before spraying (zero time) and after 1, 3, 5, 7, 10 and 14 days after application. The mortality percentages were calculated according to the equation of **Henderson and Tilton formula (1955).**

% Mortality = [1- (Ta * Cb) / (Tb * Ca)] * 100

Where: Ta: post-treatments counts.
Cb: untreated counts before treatments.
Tb: pre-treatments counts.
Ca: untreated counts after treatments.

For testing homogeneity of control agent Chi-square analysis "χ^2" method was used **Snedcor and Cochran (1982).**

$\chi^2 = \Sigma (a_i * p_i) - C_1 * P_i / P_i * q$ R= size of sample
Whereas $Pi = C_1 / G$ q= 1- Pi
ai = % corrected mortality

Control-agent preparing

Garlic extracts (*Allium sativum* L.): dip fresh garlic bulb (100 gram) in ethanol (70%) leave for 24 hours to extract and the rate for spraying (10 g/L water).

In respect to vegetable oils were: mix true of Rosemary oil (*Rosmarinus Officinailis*) and sunflower oil, Sesame oil (*Sesamum indicum* L.) (Pedaliaceae) in addation to Chili oil (*Capsicum annuum* L.) were purchased from El-Captain Company (Cap pharm) for extracting oils natural plants and cosmetics.

We added one drop of liquid soap to each oil product to obtain an emulsifiable solution.

RESULTS AND DISCUSSION

The efficiency of certain insecticides & bio-products against *Bemisia tabaci* (Geenn.) and *Tetranychus urticae* (Koch.) on potato plants

The efficiency of ten different control agents; four of them are biorational components (Garlic extract, Rosemary oil + sunflower oil, Sesame oil and Chili oil), three of them are natural pesticide (Techno Oil, Top_9 and Berna Star), one agent of them is bio-pesticide (Bio-fly) and two chemical pesticide (Blanch 48% SC, Mospilan 20% SP) in reducing the population densities of *Bemisia tabaci* and *Tetranychus urticae* on Hatma potato cultivar were assayed.

Bemisia tabaci

Efficacies of the previously mentioned compounds against the population of *B. tabaci* infesting potato leaflet are shown in **(Table 2)**. Data revealed that the Mospilan 20% recorded the highest reduction percentage 83.58 % flowed by Blanch with 73.12%. On the other hand, the Top 9 treatment recorded the lowest reduction percentage 49.32%.

Table 2. Efficiency of certain insecticides & bio-products against *Bemisia tabaci* on potato cultivar Hatma at Qaha, Qalubiya Governorate on autumn 2017.

NO.	Treatments	Initial kill	Residual effect treatments					Average
		after 1 day	3 Days	5 Days	7 Days	10 Days	14 Days	%
1	Top9	21.1	47.3	51.9	55.5	57.7	56.4	48.32
2	Rosemary oil + snflower oil	33.4	44.9	50.2	59.1	60.3	49.4	49.55
3	Chili oil	51.5	61.2	62.2	63.6	64.7	60.6	60.63
4	Garlic extract	53.3	63.6	66.8	69.9	66.9	51.7	62.03
5	Sesame oil	49	65.3	67.2	68.5	69.4	62.9	63.72
6	Bio-fly	30.7	62.3	69.3	76	77.4	67.8	63.92
7	Techno Oil	55.1	70.9	71.1	73.1	69.3	67.9	67.9
8	Berna Star	66.3	75	77.9	76	73.9	69.5	73.1
9	Blanch 48% SC	65.4	73.6	80.2	76.4	74.3	68.8	73.12
10	Mospilan 20% SP	89.4	88.5	86.4	82.9	79.9	74.4	83.58
	Control	--	--	--	--	--	--	--

Data in **Table (3)** showed that there are significant differences between the 10 compounds whereas $\chi^2 = 44.75$ sig. at 0.005, these compounds could be divided into two groups based on their reduction percentage, 1st group (a) contains on chemical pesticide (Mospilan 20% SP and Blanch 48% SC) and natural pesticide (Berna Star) and Techno Oil, respectively. The second (b) group contains on Bio-fly, Sesame oil, Garlic extract, Chili oil, Rosemary oil + sunflower oil, and Top9 (as a natural pesticide).

Table 3. Chi squre (χ^2) analysis for the change by the infestation of *Bemisia tabaci* on potato cultivar Hatma at Qaha, Qalubiya Governorate on autumn 2017.

NO.	Treatments	% corrected (ai)	R	Pi (ai/R)	ai * Pi
1	Top9	b 48.32	100	0.483	23.35
2	Rosemary oil + snflower oil	b 49.55	100	0.496	24.55
3	Chili oil	b 60.63	100	0.606	36.76
4	Garlic extract	b 62.03	100	0.62	38.48
5	Sesame oil	b 63.72	100	0.637	40.6
6	Bio-fly	b 63.92	100	0.639	40.86
7	Techno Oil	a 67.9	100	0.679	46.1
8	Berna Star	a 73.1	100	0.731	53.44
9	Blanch 48% SC	a 73.12	100	0.731	53.474
10	Mospilan 20% SP	a 83.58	100	0.836	69.86
		C_1= 645.87	G= 1000	6.459	427.46

$\chi^2 = 44.75$ sig. at 0.005

Tetranychus urticae

Efficacies of the previously mentioned compounds against the population of *T. urticae* infesting potato leaflet are shown in **(Table 4)**. Data revealed that the Mospilan 20% SP recorded the highest reduction percentage 73.1 % flowed by Techno Oil with 65.97%. On the other hand the Rosemary oil + sunflower oil treatment recorded the lowest reduction percentage 41.97%.

Table 4. Efficiency of certain insecticides & bio-products against *Tetranycus urticae* on potato cultivar Hatma at Qaha, Qalubiya Governorate on autumn 2017.

NO.	Treatments	Initial kill	Residual effect treatments					Average %
		After 1 day	3 days	5 days	7 days	10 days	14 days	
1	Rosemary oil + sunflower oil	38.9	44.2	50.4	49.3	44.7	24.3	41.97
2	Bio-fly	41	46.3	54.2	55.6	49.2	27.5	45.63
3	Berna Star	50.8	56.3	63.9	65.4	56.8	36.4	54.93
4	Sesame oil	49.9	60.6	69.9	67.4	59.4	29	56.03
5	Chili oil	54.9	59.7	68.2	64.9	55.9	42.3	57.65
6	Top9	49.4	54.3	63.7	67.8	69.3	55.7	60.03
7	Garlic extract	52.2	66.3	70.4	68.9	64.1	49.8	61.95
8	Blanch 48% SC	61.6	67.3	72.4	70.4	65.4	47.9	64.17
9	Techno Oil	58.9	67.5	73.1	74	70.7	51.6	65.97
10	Mospilan 20% SP	78.4	77.9	81.1	80.4	74.9	45.9	73.1
	Control	--	--	--	--	--	--	

Data in **Table (5)** indicated that there are significant differences between the 10 compounds whereas $\chi^2 = 83.96$ sig. at 0.005, These compounds could be divided in to two groups, 1st group (a) contains on (Mospilan 20% SP), Techno Oil, Blanch 48% SC, Garlic extract, Top9, Chili oil, Sesame oil and (Berna Star) respectively. 2nd group (b) contains on Bio-fly and Rosemary oil + sunflower oil respectively.

Table 5. Chi squre (χ^2) analysis for the change by the infestation of *Tetranychus urticae* on potato cultivar Hatma at Qaha, Qalubiya Governorate on autumn 2017.

NO.	Treatments	% corrected (ai)	R	Pi (ai/R)	ai * Pi
1	Rosemary oil+snflower oil	b 41.97	100	0.42	19.15
2	Bio-fly	b 45.63	100	0.46	25.06
3	Berna Star	a 54.93	100	0.55	30.78
4	Sesame oil	a 56.03	100	0.56	32.3
5	Chili oil	a 57.65	100	0.58	34.61
6	Top9	a 60.03	100	0.6	37.19
7	Garlic extract	a 61.95	100	0.62	39.75
8	Blanch 48% SC	a 64.17	100	0.64	42.33
9	Techno Oil	a 65.97	100	0.66	43.52
10	Mospilan 20% SP	a 73.1	100	0.73	53.44
		C1= 581.43	G= 1000	5.81	358.13

$\chi^2 = 83.96$ sig. at 0.005

Natural oils have been used as pesticides for centuries and are some of the most effective, safe alternatives to synthetic insecticides and fungicides. Safe and effective use of any oil as a pesticide, however, requires a basic understanding of its chemical nature, mode of action and limitations of use. Types of oils and oil products that are commercially available for use as pesticides include oils distilled from petroleum (also known as horticultural or mineral oils) and oils extracted from plants and animals. Plant essential oils have favorable ecotoxicological properties (low toxicity to humans, further degradation, and lower environmental impact), making them suitable to managing insects in organic farming. These oils are plants secondary metabolites and include alkaloids, amides, chalcones, flavones, kawapirones, lignans, neolignans or phenols which are important in insect-plant relationships. In this sense, essential oils represent an alternative for pest control as repellents, deterrent of oviposition and feeding, growth regulators, and toxicity to insects with low pollution and quick degradation in the environmental.

Various studies have focused on the possibility of using plant essential oils for application to control insect pests**.** Plant oils include oils extracted from plant seeds, leaves, stems or flowers. They contain fatty acids and other lipids. Some of the most common fatty acids in plant oils are palmitic, steric, linoleic and olec acids. They are commonly used in food and feed products. Many plant oils are exempt from EPA regulations and some are sold for organic production **(Carlos E. Borgan et al 2006)**.

Regardless of the source or type, all oil-based products have a similar mode of action. Insecticidal oils kill insects on contact by disrupting gas exchange (respiration), cell membrane function or structure. They also kill them by disrupting their feeding on oil-covered surfaces. Their toxic action is more physical than chemical and is short-lived. When used against plant pathogens, oils may smother fungal growth and reduce spore germination on treated surfaces. They are mostly fungistatic, stopping fungal growth rather than killing the pathogens. Some plant oils that contain sulfur compounds, such as neem oil, may possess additional fungicidal activity compared to petroleum oils (**Angelica Plata-Rueda et al 2017**).

Oils are most effective against soft-bodied arthropods. They are most commonly used against mites, aphids, whiteflies, thrips, mealybugs and scale insects. Dormant oil sprays are also used against over-wintering eggs and scales. Horticultural and plant oils are commonly used to suppress certain fungal diseases, like powdery mildew and black spot on rose. Stylet oils may be used to manage insect-vectored plant viruses.

The biocontrol mode of action of chitosan elicits natural innate defense responses within plant to resist insects, pathogens, and soil-borne diseases when applied to foliage or the soil. Chitosan increases photosynthesis, promotes and enhances plant growth, stimulates nutrient uptake, increases germination and sprouting, and boosts plant vigor (**Clive Tomlin et al 2018)**.

The results show that natural oils' average effectiveness (after 14 days of application) on *Bamisia tabaci* is between 48 – 73%, which makes Berna Star (coconut fruit core and avocado fruit seed) the most effective (73%) and similar to its effectiveness as that of Blanch 48% SC (also 73%) and Top 9 being the least effective oil (43%). Whereas on *Tetranycus urticae,* Rosemary oil was the least effective after 14 days of application (42%) and Techno Oil was the most effective (64%) and similar to its effectiveness when compared to Blanch 48% SC (which is at 65%).

Thiacloprid is an insecticide of the neonicotinoid class. Its mechanism of action is similar to other neonicotinoids and involves disruption of the insect's nervous system by stimulating nicotinic acetylcholine receptors **(Clive Tomlin et al 2018)**. Results show that Blanch 48% SC was the 2nd most effective after 14 days of application on *Bamisia tabaci* with an effectiveness of 73% and the 3rd best effectiveness on *Tetranycus urticae,* being 64%.

Acetamiprid is a nicotinic agonist that reacts with nicotinic acetylcholine receptors (nACh-R). These receptors are located in the post-synaptic dendrites of all neurons in the brain, spinal cord, ganglia and muscular junctions. The activation of the nACh-R receptors causes hyperactivity and muscle spasms, and eventually death. Acetamiprid is highly toxic to insects, but less to mammals (**Clive Tomlin et al 2018)**. Mospilan 20% SP showed was the most effective after 14 days of application on *Bamisia tabaci* and on *Tetranycus urticae,* with effectiveness of approximately 84 and 73% respectively.

When the microscopic spores of the fungus *Beauveria bassiana* come into contact with the body of an insect host, they germinate, penetrate the cuticle, and grow inside, killing the insect within a matter of days. Afterwards, a white mold emerges from the cadaver and produces new spores. A typical isolate of *B. bassiana* can attack a broad range of insects; various isolates differ in their host range. The factors responsible for host susceptibility are not known **(Clive Tomlin et al 2018)**. Bio-Fly was moderately effective after 14 days of application on *Bamisia tabaci* with an effectiveness of 64% and the 2nd least effectiveness on *Tetranycus urticae,* at approximately 46%.

These results could be explained by the selective toxicity of the Mospilan 20% SP that was based on their chemical structure and metabolic pathways. **Marzouk et al (2017)** indicated that some alterations of the values of total proteins, carbohydrates, lipid contents and specific activity of key enzymes were found in insects when the exposed to such types of chemical components.

The results also, are agreement with **Miresmailli and Isman (2006)** in Canada, who found that pure rosemary oil, caused complete mortality of spider mites *Tetranychus urticae* at concentrations that are not phytotoxic to the host plant either in the laboratory or greenhouse. Also with **Erdogan et al (2012)** in Turkey, who demonstrated the efficacy of five plant extracts included *Allium sativum* L. (Amaryllidaceae) in decreasing the capability of adult mites to lay eggs under all treatments even in the lowest concentrations compared to the control. According to, the ethanol extracts of the five oil plants had a significant mortality on *T. urticae* nymphs. Prese results are in agreement with **Iram *et al.* (2014)** in Pakistan, reported that the whitefly population was significantly suppressed by both the vegetable oils and extracts as compared to the control treatment. **Fatima et al (2015)** in Zimbabwe, approved that the red chili and garlic extracts were effective in controlling red spider mites leading to decreased infestation, increased growth, and high yield of tomatoes. **El-Fakharany et al.(2016)** in Egypt**,** studied that the efficiencies of certain compounds; Warnt (imidacloprid), Twistrid (acetamipirid), garlic oil, Kz oil, and eucalyptus oil in reducing the population density of aphids *(Aphis gossypii*, *Myzus persicae*, and *Macrosiphum* sp.), *Bemisia tabaci* and *Empoasca* spp.; they referred that the Twistrid showed a high efficiency in reducing the population density of *Aphis* spp. also, in reducing *B. tabaci* and Garlic oil showed a lowest efficiency. On the other hand, Garlic oil had little effect on predator populations, whereas Warnt had the capability to reduce predator populations. **Hussein (2017)** in Egypt, confirmed that the thyme oil treatment caused the highest repellency and anti-oviposition, followed by garlic oil against *B. tabaci*. The effect on survival of larvae was observed with garlic oil, while the greatest effect on immature stages was occurred with thyme oil. Eggs and pupae were less sensitive to plant oil treatments, compared with *Bemisia tabaci* nymphs.

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كفاءة بعض المبيدات الحشرية والحيوية ضد الذبابة البيضاء والعنكبوت الأحمر على نباتات البطاطس تحت ظروف الحقل قها – قليوبية – مصر

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الموجـــــــــز

تم اجراء تجربة حقلية بمحافظة القليوبية – قها– خلال العروة الخريفي موسم 2017 بهدف تقييم كفاءة عشرة مبيدات حشرية و حيوية مختلفة ؛ أربعة منها عبارة عن مكونات الحيوية (مستخلص الثوم وزيت روزماري + زيت عباد الشمس وزيت السمسم وزيت الفلفل الحار)، ثلاثة منها عبارة عن مبيد آفات من أصل طبيعي (تكنو أويل ، توب 9 وبيرنا ستار)، ومبيد حيوي (بيوفلاي) بالإضافة الى إثنان من المبيدات الكيميائية (بلانش 48٪SC ،موسبيلان 20 ٪SP) في تقليل الكثافة العددية لكل من الذبابة البيضاء و العنكبوت الأحمر على نباتات البطاطس صنف (هتما). أشارت النتائج إلى وجود فروق معنوية بين المركبات العشرة التي تم اختبارها في تقليل الكثافة االعددية لحوريات الذبابة البيضاء ؛ كان موسبيلان20 ٪ SP أكثر المركبات فعالية في خفض الكثافة العددية لحوريات الذبابة البيضاء بنسبة (83.58٪)، بينما أعطى(توب 9) تأثيرًا منخفضًا بنسبة خفض (49.32٪) وكان تأثير (بيوفلاي) متوسط محققا نسبة خفض (63.92٪). يمكن تقسيم هذه المركبات على اساس تأثيرها على حوريات الذبابة البيضاء إلى مجموعتين: المجموعة الأولى تحتوي على موسيبلان 20٪ SP ، بلانش48 ٪SC (مبيدات كيميائية)، بيرنا ستار وتكنو اويل (مبيدات طبيعية)، على التوالي. تحتوي المجموعة الثانية على بيوفلاي (مبيد حيوي)، وزيت السمسم، ومستخلص الثوم، وزيت الفلفل الحار، وزيت روز ماري + زيت عباد الشمس (مركبات من أصل نباتي)، وتوب 9(مبيدات طبيعية). اما بالنسبه للعنكبوت الأحمر اوضحت ان أن هناك فروق معنوية بين متوسط النسبة المئوية للابادة للمركبات العشرة المختبرة حيث سجل موسيبلان 20 ٪ SP أعلى نسبة تخفيض (73.1٪)، وسجلت معاملة (زيت روز ماري + زيت عباد الشمس) أقل نسبة انخفاض (41.97٪) وتوب 9 أعطت نسبة خفض متوسطة (60.03٪)، ويمكن تقسيم هذه المركبات إلى مجموعتين: المجموعة الأولى تحتوي على موسيبلان 20 ٪ SP ، تكنو اويل، بلانش 48 ٪ SC، مستخلص الثوم، توب 9، زيت الفلفل الحار، زيت السمسم وبيرنا ستار على التوالي، المجموعة الثانية تحتوي على بيوفلاي و(وزيت روزماري + زيت عباد الشمس) على التوالي.

الكلمات المفتاحية: الذبابة البيضاء، العنكبوت الاحمر، بطاطس، مركبات كيميائية، مستخلصات نباتية، زيوت نباتية

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