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Implementation of Eco-Friendly Control Tactics against Infestations of *Aphis craccivora* and *Tetranychus urticae* on Common Bean Plants

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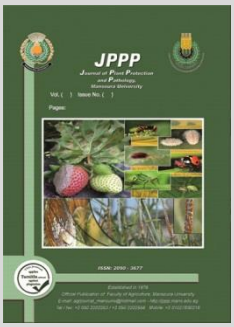

ABSTRACT

Common bean, Phaseolus vulgaris L. is an important and economic leguminous crop in Egypt due to high protein contents as human food sources. It is infested with numerous sucking-pests but the most serious pests are Aphis craccivora and Tetranychus urticae that causing serious damages on leaves, branches and pods. Therefore, this study was designed to implement some IPM tactics to decrease the infestations of these pests on this crop throughout 2022 and 2023 seasons .Results showed that the infestations by A. craccivora were higher in control than in IPM plots during 2022 and 2023 seasons. As well, the mean numbers of T. urticae were significantly differed between treatments, in which, it was ranged from 2.20-4.50 and 13.99-20.40 mobile stages/leaf in control and IPM plots during seasons 2022 and 2023, respectively. Moreover, crop parameters and yield were significantly higher in IPM than control plots. Fruit yield was 1572±50.5 and 1140±38 kg/feddan in IPM and control, respectively. The implementation of IPM tactics gave significantly highest values on vegetative, flowering and fruiting parameters throughout two seasons. This study spot a light towards developing some sequence treatments in IPM against sucking pests including the application of nova-plus, azomix+ nematodor, nova-k, plant extracts including pepper-extract, garlic oil, canola oil, orange oil, jojoba oil and releasing of the predator mite, Phytoseiulus persimilis on common bean. This program would not only help to reduce the infestations, but also it help to put the management plan to safe control of for these serious pests

Keywords: *Aphis craccivora*, *Tetranychus urticae*, *Phaseolus vulgaris*, IPM, Botanical pesticides.

INTRODUCTION

Common bean, *Phaseolus vulgaris* L. is one of the most important leguminous crops and is widely cultivated for its edible seeds and seedpods in Egypt (Abdou *et al*., 2019). Due to high protein contents, *P. vulgaris* considers an economical important crop for human food sources (Boudoin and Maquet, 1999 and Arulbalachandran and Mullainathan, 2009). *Phaseolus vulgaris* is cultivated for fresh and dry pods for local consumption and exportation (Abdou *et al*., 2019). This crop is infested with numerous sucking pests but the most serious pests are the cowpea aphid, *Aphis craccivora* and the two-spotted spider mite, *Tetranychus urticae* that causing serious damages on leaves, branches and pods (Abd EI-Gawwad, 2004 and El. Lakwall *et al*., 2010). The rapid developmental rate, short generation time and high net reproductive rate of *A. craccivora* and *T. urticae* allows them to multiplying damage and population levels very quickly when conditions are suitable, resulting in an equally rapid decline of host plant quality (Fathipour *et al*., 2006 and Abd EI-Gawwad, 2004). The environmental pollutions caused by chemical or/ synthetic pesticides and their residues have been increased (Manda *et al*., 2020 and Ngegba *et al*. 2022) and therefore seeking new alternative control methods are appreciated.

Alternative control strategies such as natural components that derived from plants and predators are suitable for use in Integrated Pest Management (IPM) programs. Botanical pesticides are more rapidly degraded than most chemical pesticides and less kill beneficial insect than synthetic pesticides, therefore, considered eco-friendly control tactics (Ignacimuthu and Vendan, 2008). It is therefore highly advised that biological pesticides be utilized widely in integrated pest management (IPM) programs as an essential, eco-friendly approach to controlling pests (Archana *et al*., 2022).

Plant oils have been found useful for controlling whiteflies, young scales, mites and many other plant pests present during the growing season (Broza *et al*., 1988). Mapuranga *et al*. (2016) used *Capsicum annum* extract to control *Aphis gossypii*. They reported that aphid populations reduced from 80.3% and 72.2% at 20% of *C. annum* extract on cotton field trial. This plant extract has repellence and contact toxicity against aphids as a suitable alternative aphidicides for aphid management. Additionally, Mahmoodi *et al*.(2019) found that the red pepper extract (85%) was effective in decreasing of fig mite, *Eotetranychus hirsti* damage. The reduction of mite was exceeded over than 90% on fig trees. Both garlic and hot pepper extracts were applied for cabbage pest management. The use of these extracts achieved 55.94% mortality against the cabbage aphid, *Brevicoryne brassicae* (Baidoo and Mochiah 2016). Also, 40% garlic-based extract namely GC- mite was effective against the red spider mite, *T. evansi* on tomatoes under greenhouse and field conditions (Kithusi, 2005). Moreover, Dutra *et al*. (2020) used garlic *Allium tuberosum* leaf and *A. sativum* bulb extracts to control of *A. craccivora* nymphs on cowpea under greenhouse conditions.

Commercially, the plant extract products such as GC-Mite extract based garlic oil, SMC (contained canola, coriander oil and triethanolamine) and Bug Assassin

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(eugenol, sodium lauryl sulfate, peppermint and citronella oil) were highly effective against the two-spotted spider mite and achieved mortality ranged from 80 to 90 % (Cloyd et al., 2009). Montasser *et al*. (2011) reported that canola oil 2% and orange oil (D-Limonene) were moderately effective against the broad mite *Polyphagotarsonemus latus* stages on pepper plants under greenhouse conditions. D-Limonene, one of the main constituents of citrus oil, is an example of a natural plant pesticide that is widely used as a botanical extract caused repellent, anti-feeding, phago-stimulant and toxin activities (Walia *et al*., 2014). Also, De Sousa *et al*. (2021) conducted that d-limonene application was reduced the population of *A. craccivora* on bean crop for up to 27 days. Limonene –is a closely related active ingredient that is an extract from orange and other citrus fruit peels. Limonene extracts have been combined with agricultural soap for act as contact poisons to control aphids and mites. It evaporates readily from treated plants and have no residual effect (Peshin and Dhawan, 2009). In addition, jojoba oil act as aphidicidal activity for controlling aphid species especially *A. craccivora* by El-Harriry *et al*. (1998).

The combined effect of a mixture of essential oils (clove, lavender, eucalyptus, and sweet orange) on *T. urticae* and its associated predator, *P. persimilis* were evaluated by Allam *et al*. (2023) on eggplant, cucumber and pepper crops. They found that the total constituents of this mixture were 43 compounds based primarily d-limonene. The using of the predatory mite, *P. persimilis* was reduced of *T. urticae* population on apple up to 89% mortality (Metwally *et al*., 2010). However, *Hassan et al.* (2023) conducted that a low side effect of the plant extract being 24% mortality in predatory mite *P. persimilis* population and 3.85% mortality in predatory insect *Orius albidipennis* population. Bio-pesticides possess attractive properties that render these desirable substances of an integrated pest management. Most botanical pesticides are used, they had a little or non-toxic residues, and lower costs than the chemical pesticides (Hajek, 2004). Therefore, bio-pesticides are greatly attracting on the target-specificity, biodegradability, eco-environment and suitability in IPM. Recently, the using of the combined between biological control and botanical pesticides in IPM was encouraged. Therefore, the current study herein focused and implemented some biocontrol tactics against *A. craccivora* and *T. urticae* infested common bean plants throughout 2022 and 2023 seasons to avoid bad effective of chemical or/ synthetic pesticides.

MATERIALS AND METHODS

Field experiments was performed in a private farm at El-Hamol village, Menoufia governorate, Egypt on common bean during two fall seasons of 2022 and 2023, to compare some tactics of integrated pest management (IPM) program against infestations of *A. craccivora* and *T. urticae* with a neglected field (control) . Seeds of common bean, Giza 6 variety were sown at 15th August during the two seasons in a traditional soil cultivation system. Seeds were soaked in Imidacloprid 70% WS at rate of 7 gram/1 kg for 12 hours before sowing. Two seeds/hole were planted with 25 cm between holes. The field experiment was received standard commercial practices.

An experimental area of 1.050 m^2 was set up in a complete randomized block design with replicated three times. IPM program consisted of some biocontrol tactics as shown in Table (1). Control plots were sprayed by water only. *Aphis craccivora* individuals and *Tetranychus urticae* mobile stages in IPM and control field programs was weekly recorded in a random sample of 30 leaves from each treatment (10 leaves/ replicate) after 20 days of sowing until the end of experiment during 2022 and 2023 seasons. Sample were kept in paper bags and transferred to the laboratory of plant protection research institute, Dokki, Egypt for inspection under a stereomicroscope to count the numbers of *A.craccivora* individuals and *T. urticae* mobile stages.

The fruit common bean production in each treatment was recorded during the two fall successive seasons, 2022 and 2023. Some vegetative parameters (plant height/cm and numbers of branches/plant), flowering (numbers of flowers/plant) and fruiting (numbers of buds/plant and yield (kg)/feddan) of common bean treatments were measured during the two seasons. The obtained data was statistically compared using t-test at 5% levels of probability. Statics were performed using SAS program computer (SAS, 2003)

Table 1. Integrated pest management program applied at common bean field against *A. craccivora* and *T. urticae* along 2022 and 2023 seasons.

Treatment date	Trade name	Active ingredient	Rate of application	Notes
5th Aug. Pre-planting	Nova-plus	P and K + *Bacillus subtilis* + *B. licheniformis* + Methonine + LycineHCl + triponine + Glycine + propaline glycol	20 L/ fed.	Soil treat.
15th Aug.	Common bean seeds were sown			
27th Aug.	Nova-plus		20 L/fed.	Soil treat.
	Azomix + Nematodor 95%	*Azotobacter chroococcum* + vinegar wood 95%	1.5 L/fed.+ 4 L/fed.	Soil treat.
10th Sept.	Nova-K	P and K (high) + *Bacillus subtilis* + *B. licheniformis* + Methonine + LycineHCl + triponine + Glycine + propaline glycol	10 L/fed.	Foliar treat.
	Captivaprim 86% SC	A mixture of C*apsicum oleoresin* 7.6%+Garlic oil 23.4%+canola oil 55%	100 cm^3/100 L	Foliar treat.
16th Sept.	Top Nature 24% EC	24% Orange oil (d-limonene)	200 cm^3/100 L	Foliar treat.
1st Oct.	Phytoseiid predator, *Phytoseiulus persimilis*	*P. persimilis*	10 boxes (20,000 individuals)/fed.	Predator Releasing
8th Oct.	Top-healthy 60%EC + Captivaprim 86% SC	Jojoba oil+ A mixture of C*apsicum oleoresin* 7.6%+Garlic oil 23.4%+canola oil 55%	500 cm^3/100 L+100 cm^3/100 L	Foliar treat.
15th Oct.	Phytoseiid predator, *Phytoseiulus persimilis*	*P. persimilis*	10 boxes (20,000 individuals)/fed.	Predator Releasing

L=liter fed.= Feddan treat.= treatment

RESULTS AND DISCUSSION

Legume aphid, *A. craccivora* infestations:

The obtained results in Table (2) show the effect of an integrated pest management program IPM applied at common bean field against *A. craccivora* along 2022 and 2023 seasons. Regarding to the statistical analysis of the first season results, the mean numbers of aphid stages, *A. craccivora* infesting common bean plants, the data revealed that there were significantly different between treated and control plants. The highest aphid numbers at treated plots were recorded at 26th September 7.54±0.39 individual/ leaf compared to 254.37±108.62 individual/ leaf at 3rd October in control plots, while the least numbers of aphid numbers for treated plots were recorded at the last sample 8th November as 0.24±0.17 individual/leaf compare with 10.62±6.87 individual/ leaf at control plots.

As for results of the second season, the mean numbers of *A. craccivora* individuals were significantly different between treated and control plants. The highest infestation numbers at treated plots were recorded at 26th September 4.20±0.90 individual / leaf compared to 161.71±69.95 individual/ leaf at 3rd October in control plots, while the least numbers of aphid numbers for treated plots were recorded at the last sample 8th November as 0.40±0.09 individual/leaf compare with 15.07±10.71 individual/ leaf at control plots. With t- test analyses, aphid individuals infested common bean plants was showed a highly significant value between IPM field and control field during the two seasons, 2022 and 2023 (Table, 2). Generally, the overall aphid activity on common bean plants was higher in control field program than in IPM field program after the suggested applications as shown in Table (1).

Table 2.Mean numbers (±SE) of *A. craccivora* on common bean plants after the application of an IPM program.

Sampling dates	Mean numbers of *Aphis craccivora* individuals/ leaf			
	Fall season 2022		Fall season 2023	
	IPM program	Control plot	IPM program	Control plot
05th September	6.61±0.69	7.15±0.66	7.39±0.42	7.82±0.18
12th Sept.	3.17±0.81	12.37±0.36	4.48±1.46	13.91±0.90
19th Sept.	2.49±1.01	12.32±1.77	1.93±0.47	13.75±2.46
26th Sept.	7.54±0.39	33.60±14.17	4.20±0.90	92.59±23.94
03rd October	1.76±0.47	254.37±108.62	2.94±1.14	161.71±69.95
10th Oct.	0.05±0.01	171.24±77.59	0.40±0.17	149.28±66.54
17th Oct.	0.82±0.34	70.72±12.82	1.20±0.21	54.31±14.92
24th Oct.	1.18±0.41	28.15±6.68	0.87±0.47	29.41±13.29
01st November	0.85±0.49	29.05±7.66	0.84±0.10	23.31±0.72
08th Nov.	0.24±0.17	10.62±6.87	0.40±0.09	15.07±10.71
Overall Mean ± SE	2.47±0.83	62.96±26.38	2.46±0.72	56.12±18.42
t	- 3.20		- 4.03	
P	0.002		0.0002	

In the present work, the using of capsicum extract in the selected biological treatments against *A. craccivora* was highly reduced aphid infestations from 59.54 to 2.47 individuals/ leaf (Figure 1). These data were in the direction of those findings that obtained by Mapuranga *et al*. (2016) who stated that *Capsicum annum* extract reduced *Aphis gossypii* populations ranged 72.2-80.3% on cotton field, in which it act as repellence and contact poison. It was a good alternative aphidicide to aphid control. Moreover, the obtained results show the essential oils such orange oil (D-limonene), jojoba oil, canola oil, garlic oil as biological agents for controlling aphids on common bean was more effective, it was recorded a reduction % of infestation up to 62.96% through two tested fall seasons 2022 and 2023. Similarly, Cloyd *et al.* (2009) demonstrated that different plant-derived essential oils vary in their effectiveness for controlling of arthropod pests, two-spotted spider mite, *T. urticae* and green-peach aphid, *Myzus persicae*. They stated that citric acid had more effective toxicity against the mite (≥90% mortality). Also, a mixture of canola, coriander oil, and tri-ethanol amine provided mortality percentage > 80% on western flower thrips. In addition, they demonstrated that plant-derived product based cotton seed, clove, and garlic oil and commercially plant extract based rosemary, cinnamon, clove oil, and garlic extract provided sufficient control of whitefly and green peach aphid up to 21 days after application. Moreover, Dutra *et al*. (2020) used hydro-alcoholic plant extracts to control of *A. craccivora* nymphs on cowpea under greenhouse conditions. They reported that garlic *Allium tuberosum* leaf and *A. sativum* bulb extracts was recorded more than 50% efficiency. It may be efficiency against cowpea-black aphid.

Two-spotted spider mite, *T. urticae* infestations:

The obtained data in Table (3) show the effect of an integrated pest management program applied at common bean field against the two-spotted spider mite, *Tetranychus urticae* along 2022 and 2023 seasons. Regarding to the first fall season, statistical analysis of the data on the mean numbers of mite mobile stages, *T. urticae* infesting common bean plants revealed that there were a highly significant differences between treated and control plants. The highest mite numbers at treated plot were recorded at 10th October 18.75±4.28 mobile stages/ leaf compared to 54.60±18.66 mobile stages/ leaf at 24th October in control plot, while the least numbers of mite numbers for treated plot were recorded at the last sample 8th November as 0.05±0.01 mobile stages/leaf compare with 9.42±2.49 mobile stages/ leaf at control plot. During the second fall season, the obtained data on the mean numbers of mite mobile stages, *T. urticae* revealed that a high significant was observed between treated plants and control plants. The highest mite numbers at treated plot were recorded at 24th October being 6.89±0.83 mobile stages/ leaf compared to 46.27±5.60 mobile stages/ leaf, while the lowest number of mite for treated plot was recorded at the last sample 8th November as 0.40±0.06 mobile stages/leaf compare with 8.60±2.79 individual/ leaf at control plot.

The two-spotted spider mite, *T. urticae* is challenging Tetranychid pest to control due to its rapidly dispersal on numerous host plant with high development capacity, which it may be lead to acquired resistance. *T. urticae* are well managed by a combination selected tactics of IPM program which consisted of the application of nova-plus, azomix+ nematodor, nova-k, plant extracts including *Capsicum oleoresin* extract, garlic oil, canola oil, orange oil (d-limonene), jojoba oil and releasing of phytoseiid predator, *P. persimilis* on common bean.

Concurrently, in the present study revealed that the combined effect between plant extracts as botanical pesticides and releasing of the phytoseiid predator mite, *P. persimilis* is a suitable alternative bio-control method in IPM tactics to suppress *T. urticae* individuals. There were agree in the line of those findings by Hassan *et al.* (2023) who reported that plant extract was recorded a low side effect being 24% mortality on *P. persimilis* and 3.85% mortality on the predatory insect *Orius albidipennis.* Allam *et al.* (2023) used d-limonene for controlling spider mite on eggplant, cucumber and pepper crops. In the present data, the different selected of plant-derived extracts more effective against T. urticae compared to the untreated plot. Similarly, Mamoudi *et al.* (2019) reported that hot pepper extract 85% decreased of fig mite, *Eotetranychus hirsti* infestations over than 90% reduction in its population on fig trees. In addition, Kithusi (2005) demonstrated that garlic-based product, namely GC-mite (40% garlic extract) under laboratory, field and greenhouse conditions had highly efficacy in reducing of red spider mites *T. evansi* on tomatoes. It caused 54% and 85% adults and larvae mortality, respectively. Also, Montasser *et al.* (2011) conducted that 2 % canola oil were recorded of 77.54 % and 53.95 % reduction in broad mite *Polyphagotarsonemus latus* populations on pepper plants under greenhouse conditions. Therefore, the used of suggested plant extracts and releasing of Phytoseiid predator in the present study is a suitable alternative bio-control method in IPM tactics for suppressing of *T. urticae* on common bean cultivations.

Table 3.Mean numbers (±SE) of the two-spotted spider mite, *T. urticae* on common bean plants after the application of an IPM program.

Sampling dates	Mean numbers of *Tetranychus urticae* mobile stages/ leaf			
	Fall season 2022		Fall season 2023	
	IPM program	Control plot	IPM program	Control plot
05th September	0.43±0.30	0.29±0.16	0.82±0.46	0.78±0.28
12th Sept.	0.24±0.04	2.83±0.27	0.57±0.44	2.83±0.44
19th Sept.	0.19±0.01	0.29±0.14	0.40±0.17	0.92±0.22
26th Sept.	2.71±0.62	3.96±1.23	2.36±0.40	3.03±1.13
03rd October	5.37±2.38	32.88±3.51	1.30±0.79	20.67±7.73
10th Oct.	18.75±4.28	33.32±10.86	4.44±1.58	11.34±0.41
17th Oct.	5.25±1.96	46.24±15.69	1.88±0.14	28.56±6.37
24th Oct.	6.20±2.67	54.60±18.66	6.89±0.83	46.27±5.60
01st November	5.86±0.72	20.18±1.34	2.90±0.57	16.89±0.99
08th Nov.	0.05±0.01	9.42±2.49	0.40±0.06	8.60±2.79
Overall Mean ± SE	4.50±1.78	20.40±6.38	2.20±0.66	13.99±4.63
t	- 3.65		- 4.21	
P	0.0006		0.0001	

The implementation of proposed IPM tactics significantly reduced the populations of *A. craccivora* and *T. urticae* on common bean compared to control plot (Figure 1) . The overall mean numbers of two tested piercing-sucking pests was 59.54 aphid individuals and 17.19 mobile stages of mite per leaf in control plot while it was very low in IPM plot being 2.47 aphid individuals and 3.35 mobile stages of mite per leaf after the application of the selected tactics of the control program in the present work.

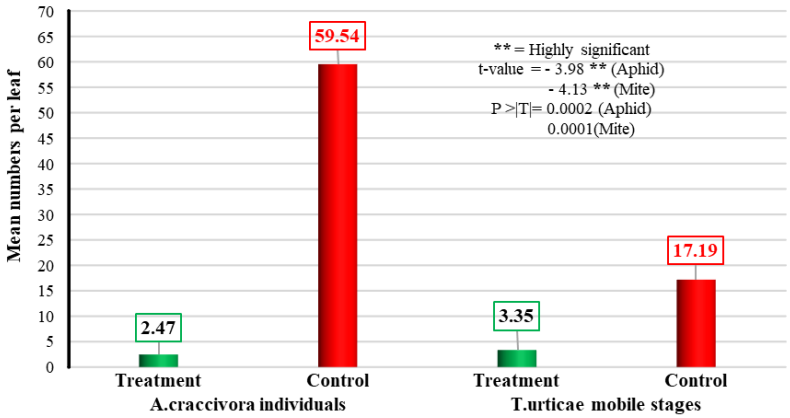

Figure 1. Mean numbers of two piercing-sucking pests on common bean plants after the applications of an IPM program.

Common bean yield:

Data in Table (4) show that IPM plot application significantly gave the highest common bean production than untreated check plot (control) against aphid, *A. craccivora* and the two spotted spider mite, *T. urticae* infestations in two tested seasons, 2022 and 2023 in vegetative, flowering and

fruiting parameters. As for the effect of the tested IPM program at the first 2022 season, the obtained results indicated that there were significant differences in all measured plant characters, between treated and control plots (Table 4). Regarding to plant height at first season, it was 71.8±3.2 cm at treated plot compare with only 47.6±2.6 cm at control plot, while it was 73.2±3.9 cm at treated plot and only 49±3.0 cm at control plot of the second season 2023. In case of the number of branches during 2022, it was recorded a low significant between treated and control plots while no significant difference at the second season 2023. Moreover, a low significant was reported with the number of flowers/ plant at first season, it was 15.4±0.7 at treated plot compare with only 8.4±2.2 at control plot, while it was slightly high being 16.8±1.6 at treated plot and only 9.8±2.3 at control plot of the 2nd season. Data in Table (4) indicated that a high significant in case of the number of pods/ plant through 1st and 2nd seasons, it was 29.8±2.6 and 31.2±3.8 at treated plot compare with only 17.4±2.8 and 18.8±2.1 at control plot in 2022 and 2023 seasons, respectively. Additionally, the fruit yield/ feddan was highly significant being 1555.2±44.5 and 1588.8±60.0 kg at treated plots compare with only 1123.2±30.7 and 1156.8±49.4 kg at control plots during fall seasons 2022 and 2023, respectively.

Table 4. Some vegetative, flowering and fruiting parameters of common bean

Seasons	Treatments	Crop parameters and yield of common bean				
		Plant height cm	No. of branches / plant	No. of flowers / plant	No. of buds / plant	Fruit yield kg/feddan
Fall season 2022	IPM program	71.8±3.2	7.4±0.7	15.4±0.7	29.8±2.6	1555.2±44.5
	Control	47.6±2.6	4.8±0.7	8.4±2.2	17.4±2.8	1123.2±30.7
	t	5.85	2.60	2.98	3.25	7.99
	P	0.0004	0.03	0.02	0.01	0.0001
Fall season 2023	IPM program	73.2±3.9	8.8±1.4	16.8±1.6	31.2±3.8	1588.8±60.0
	Control	49±3.0	6.2±1.4	9.8±2.3	18.8±2.1	1156.8±49.4
	t-	4.97	1.34	2.48	2.88	5.56
	P	0.001	0.22	0.04	0.02	0.001
Overall mean	IPM program	72.5±3.5	8.1±0.9	16.1±1.0	30.5±3.2	1572±50.5
	Control	48.3±2.7	5.5±0.9	9.1±2.2	18.1±2.4	1140±38.1
	t	5.47	2.08	2.88	3.13	6.83
	P	0.001	0.07	0.02	0.01	0.0001

Finally, the implement of selected IPM tactics significantly gave the highest common bean production compared to control plot against piercing-sucking pests, *A. craccivora* and *T. urticae* infestations in vegetative, flowering and fruiting parameters throughout tested fall seasons, 2022 and 2023. Accordingly, the obtained results clearly indicated that IPM field program may be the suitable program for controlling piercing-sucking pests, *A. craccivora* and *T. urticae* infestations on common bean cultivations at Menoufia governorate. Common bean, *Phaseolus vulgaris* L. is one of the most exported leguminous crops and is widely cultivated for their edible seeds and seedpods in Egypt, so that, the plant extracts include essential oils should be one of the best alternative to harmful chemical pesticide or safety management elements against piercing-sucking pests, *A. craccivora* and *T. urticae* on this crops, as like as, Mordue (2004) reported that the using of Bio-pesticides extracted from plants that had the toxicity, repellant, anti-feeding and anti-egg-laying property is one of the important alternatives to these traditional pesticides. Also, Hajak (2004) Bio-pesticides are ideal elements of an Integrated Pest Management because they have a number of appealing qualities. The majority of botanical pesticides have lower costs than traditional chemical pesticides, are mostly selective, and have little or/ no harmful residues (Hajek, 2004). For this reason, the target-specificity, effectiveness, environmental safety, and suitability for IPM programs of bio-pesticides are generating a lot of attention. In this regard, bio-pesticides are more successful than synthetic chemical pesticides in reducing environmental pollution. Moreover, these selected botanical pesticides in the current study may be had insecticide activity as Duke (1990) and Khater (2012). They stated that a wide range of characteristics are possessed by botanicals, including toxicity to mites, snails, slugs, nematodes, and other agricultural pests, anti-feeding activity, insecticidal activity, and pest repellence.

Additionally, behind these activity of botanical-based pesticide against of aphid and mite, it may be act as induce acquired plant resistance, similarly, Karani *et al*. (2017) and Bhuvaneshwari *et al*. (2015) found that when botanical pesticides (BPs) are used, they have the following effects: they can kill the pest, disrupt its physiology and development, keep it away from the surface, or cause the plant to acquire induced systemic resistance. In previous studies, main challenges in common bean production include pests, highly pesticide costs (Kasina, 2003 and Monda *et al*., 2003), therefore, the present study offer the important role of botanical-based pesticide and natural predator in IPM program in common bean crop.

CONCLUSION

The *A. craccivora* and *T. urticae* is challenging piercing-sucking pests to control due to its rapidly dispersal on numerous host plant with high development capacity, which it may be lead to acquired resistance. Both two pests are well managed by a combination selected tactics of IPM program which consisted of the application of nova-plus, azomix+ nematodor, nova-k, plant extracts including *Capsicum oleoresin* extract, garlic oil, canola oil, orange oil (d-limonene), jojoba oil and releasing of the phytoseiid predator mite, *Phytoseiulus persimilis* on common bean. So that, the present study offers the important role of botanical-based pesticide and natural predator in IPM program in common bean crop.

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تطبيق بعض طرق المكافحة الصديقة للبيئة ضد الاصابة بمن البقوليات *Aphis craccivora* و العنكبوت الأحمر ذو البقعتين *Tetranychus urticae* على نباتات الفاصوليا

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الملخص

تعد الفاصوليا أحد أهم المحاصيل البقولية الهامة إقتصاديا ويتم زراعتها فى مصر على نطاق واسع لاحتوائها على نسبة عالية من البروتين .وتصاب الفاصوليا بالعديد من الآفات الثاقبة الماصة اهمها حشرة من البقوليات والعنكبوت الاحمر ذو البقعتين والتى تسبب أضرارا للاوراق والبراعم الزهرية والقرون . تم تنفيذ هذة التجربة لتطبيق بعض مواد المكافحة الحيوية الآمنة على الأفتين خلال موسمى 2022&2023 . وأظهرت النتائج ان اعلى معدلات الاصابة بمن البقوليات كانت فى الكنترول مقارنة بالمعاملات فى برنامج الادارة المتكاملة خلال موسمى الدراسة . اما بالنسبة لآفة العنكبوت الاحمر فقد أظهرت النتائج فروق معنوية واضحة بين برنامج المكافحة والكنترول بمعدل اصابة بين 2.20 – 4.50 فرد / ورقة فى المعاملة وفى الكنترول كانت بمتوسط 20.40 – 13.99 على التوالى . وقد اوضحت النتائج ان هناك فروق معنوية عالية لانتاجية الفدان والصفات المحصولية للفاصوليا بين كل من برنامج المكافحة والكنترول حيث اعطت متوسط 50.5 ±1572 كيلو /فدان فى المعامل مقارنة ب 35 ±1140 كيلو / فدان فى الكنترول حيث ادى استخدام البرنامج على الآفتين الى تحقيق اعلى انتاجية بفروق معنوية واضحة فى الصفات المحصولية كالنمو الخضرى والتزهير وعدد القرون بين كل من البرنامج والكنترول خلال موسمى الدراسة. ومن هذة الدراسة يمكن الاستفادة من برنامج المكافحة المستخدم ضد الأفتين على الفاصوليا ويشمل نوفا بلس , ازميكس +نيماتودور , نوفاكى وبعض المستخلصات النباتية مثل الفلفل الحار وزيت الثوم وزيت الكانولا وزيت البرتقال وزيت الجوجوبا مع اطلاق احد المفترسات الاكاروسية فيتوسيلس برسيملس ، وتعد المعاملات المستخدمة فى برنامج المكافحة من الاساليب الهامة فى اعداد برنامج ادارة متكا ملة لمكافحة حشرة المن واكاروس العنكبوت الاحمر على الفاصوليا .

الكلمات الدالة : مّن البقوليات ، العنكبوت الاحمر ، الفاصوليا ، الادارة المتكاملة للافة ، المستخلصات النباتية.