Annals of Agricultural Science, Moshtohor (ASSJM)
https://assjm.journals.ekb.eg/
www.fagr.bu.edu.eg
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Original Article Vol. 61(2) (2023), 543 – 552 DOI: 10.21608/ASSJM.2023.320340

Reducing the Population Density of Aphids and Leafminer Infesting Snap Bean Plant by Using Some Insecticides with Different Active Ingredients

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Abstract

Afield experiment was conducted during season, 2020, at the experimental vegetable farm of Asfaina,Toukh, Qalyubia Governorate, Egypt. To study the efficiency of five chemical compounds (acetakel 20% (acetamiprid),Transform50%(Thalfoxaflor), Vertimec1.8%(Abamectin), Pelexam25%(thiamethoxam) and sulfur30%(sulfur). In reducing the population density of insect pests including aphids (mainly *Aphis gossypii, Myzus persicae and A. craccivora*) and leafminer*(Liriomyza trifolii)* infesting snap bean, *Phaseolus vulgaris* cultivar Falantino. The obtained results showed that the compounds, Transform, Pelexam,Acetakill and Vertimec recorded the highest reduction percentage and reduced the number of aphids on bean plants. As for leafminer , the pesticides Transform and Vertimec showed the highest percentage of reduction of leafminer number, while acetakel and Pelexam had a small effect in reducing insect number.On the other hand, infesting snap bean.

Keywords:: snap bean (*Phaseolus vulgaris* L.) , *Aphis craccivora* Koch *Liriomyza trifolii*

Introduction

Phaseolus vulgaris it is origin crop in Middle-South-America. It is major as well as important world crop with almost 20 million tons seeds produced per year, ranking directly after soybean peanuts in the world production of grain legumes **(FAOSTAT 2001).** *Phaseolus vulgaris* (L.) is an annual leguminous plant that belongs to the family Leguminaceae, Common bean is the most important grain legume for direct human consumption with production more than twice that of the next most important grain legume, chickpea **(Abdou *et al*., 2019 and Gepts *et al*., 2008).** In Egypt, the cultivated area of snap bean has increased in recent years, especially in newly reclaimed areas in the open field and under greenhouses to cover needs for local consumption and export to foreign markets. **(Shehata *et al*., 2011).**Worldwide, yield losses due to insect pests alone have been estimated to be from 35% to 100% annually **(Singh and Schwartz, 2011)**.

In Egypt, *Liriomyza trifolii* (Burgess) (Diptera: Agromyzidae) caused significant economic losses and damages to many bean crops **(Shahein and EL-Maghraby, 1988)**. Aphids and whitefly insect pests are considered two of the most important pets on common bean plants during the three growing periods, seedling, flowering, fruiting. They can cause several damages to many crops by directly feeding on phloem sap and indirectly by transmitting viral disease. **(Satar and Uygun, 2012).**

This study aimed to evaluate the efficiency of five chemical pesticide compounds (Acetakill20% (acetamiprid) , Transform50% (Thalfoxaflor), Vertimec1.8% (Abamectin) , Pelexam25% (thiamethoxam) and sulfur 30% (sulfur) in reducing the population density of insect pests infesting snap bean, Phaseolus vulgaris cultivar Falantino .

Materials and Methods

Field studies were conducted at the experimental vegetable farm of Asfaina,Toukh, Qalyubia Governorate, Egypt. During season 2020 to evaluate the efficiency of five chemical pesticide compounds acetakel 20 % (acetamiprid), Transform50% (Thalfoxaflor), Vertimec1.8% (Abamectin), Pelexam25 % (thiamethoxam) and sulfur30 %(sulfur) in reducing the population density of insect pests infesting snap bean cultivar (Falantino,). Each replicate was about 10.5m2. All replicates were arranged in randomized complete block design (RCBD) using 3 replicates for each insecticide. Plant of the snap bean cultivar (Falantino) was sprayed after 30days from planting. **(Table, 1)** illustrated the five studied compounds

which were applied to determine their efficiency in reducing the population density of snap bean studied pests infesting snap bean cultivar . All the normal agricultural practices for cultivation of snap bean plant were done and the pesticides were applied at the recommended doses shown in **(Table, 1)** by using a 20 L knapsack sprayer with one nozzle. The amount of water was calibrated to obtain sufficient coverage the insecticides on of snap bean plants. Spraying was conducted early in the morning .Ten snap bean leaflet per replicate were picked at random, put in a tightly closed paper bags and transferred to the laboratory, in the same day by using stereomicroscope inspection to determine the effect of the tested compounds. The plant samples were taken before spraying as well as after 1, 3, 5, 7, 11 and 14 days respectively to calculate the (aphid and whitefly) insects' population density.

Table 1. Pesticide compounds used in the present study.

NO	Trade name	Concentration of A.I.	F	Common name	Rate of application / 100 L of water
1	Acetakel	20%	SP	acetamiprid	25g/100L
2	Transform	50%	WG	Thalfoxaflor	25g/100L
3	Vertimec	1,8%	EC	Abamectin	40cm/100L
4	Pelexam	25%	WG	thiamethoxam	30g/100L
5	Sulfur	30%	L	Sulfur	40cm/100L

A.I = Active ingredient
F = Formulation
EC = Emulsifiable concentrate.
SP = Water soluble powder
W G = Water dispersible granules

C. Statistical analysis.

Statistical analysis were performed by using SAS program computer including F test and L.S.D. value (least significant difference) to find differences between seasonal mean number of certain insects after spraying with the five tested insecticides (SAS Institute 2003).In the chemical control, the reduction percentages in the population density of certain insects were calculated according to Handerson and Tilton equation (1955).

Results and Discussion

1- Aphids (included *A. gossypii*, *Myzus persica* and *A. craccivora)*

In this experiment the pre count of aphids were 188.60, 246.00, 189.40, 200.60 and 192.20 individuals/leaflet in the experimental area of Transform, Acetakel, Pelexam, Vertimec and sulfur respectively. After one day of spraying, the reduction percentages of aphid's population were 97.76, 86.87 ,78.84,10.58 and 60.32% in case of the respective tested insecticides. Statistical analysis showed that Transform was more potent after 24 hours from application in reducing the population density of aphids followed by Acetakel, respectively. On contrast, Vertimec was the least potent one as it gave the highest number of aphids after 24 hours. (184.40 indiveduals/ leaflet). After three days of application, the reduction percentages of the total population of aphids /10 leaflet were increased comparing with the population after one day. The reduction percentages based on control were 97.94, 96.77, 96.58 and 100% in the experimental area of Transform, Acetakel, Pelexam and Vertimec respectively, on other hand the reduction percentages was decreased in sulfur experimental area being 40.94%. The data had the same trend after five days from application as vertimec was occupied the first group (a) (100% reduction)followed insignificantly by Transform, Acetakel and Pelexam which presented at the second group (b) (97.94, 96.77 and 96.58% respectively).On the contrary sulfur presented at the last group of insect reduction and gave 12.51%. After seven days of treatments, the first four insecticides (Transform, Acetakel, Pelexam and Vertimec) retained their efficiency in reducing the population density of aphids as their efficiency exceeded 95% as the reduction percentage arranged descendingly to Vertimec (100%)>Transform(95.95%)>Pelexam(95.27%)>Acetakel (95.17%)> Sulfur (5.48%) .

After 11 and 14 days, the reduction percentage of Transform, Acetakel, Pelexam and Vertimec increased, being 99.97 and 100% &96.88 and 100%&94.20 and 96.29 %&97.92 and 99.96 %. While again sulfur gave the significantly the lowest reduction, 25.95 and 22.31% respectively.

Regarding the mean reduction of the five tested compounds, statistical analysis revealed that Transform gave significantly the highest reduction percentage (98.37%) and occupied the first group (a) followed significantly by Acetakel and Pelexam which presented in the second group (b) and gave 95.30 and 92.87%, respectively. The third and fourth groups (c and d) contained the lowest efficiency compounds; i.e. Vertimec and sulfur, 84.54 and 27.97%, respectively.

Finally, it could be suggested that Transform, Acetakill and Pelexam gave the best results in

reducing the population density of aphids (mainly A. gossypii, Muzus persica and A. craccivora) infesting snap bean crop.

2- leafminer (Liriomyza trifolii).

Data tabulated in (Table 3) indicated that the highest insecticidal efficiency in reducing of the population density of L. trifolii larvae occurred by applying Acetakel (26.93% reduction) after 24 hours of spraying, while Transform and Pelexam gave an intermediate efficiency on the reduction percentage of leafminer population (9.76 and 7.96 % reduction, respectively). Vertimec gave significantly the lowest reduction (0.94%) On the other hand sulfur gave negative reduction percentage (-12.31%) After three and five days of application, results indicated that the bioactivity of Vertimec increased gradually, as their reductions were 65.67 and 80.77% followed significantly by Transform and Acetakel, which gave reduction percentages of 44.83 and 56.11 & 35.20 and 37.70%, respectively, followed by Transform which presented in the second group and gave reduction percentages of 80.98.

On the other hand, Sulfur took the same trend and had no effect on the population density of leafminer being 16.92%. At 11 and 14 days after application the efficiency of Transform increased and reached to maximum effect, 89.56 and 100%, respectively followed by Acetakel and Vertimec, being 55.75 and 56.47 &78.46 and 54.72 %, respectively. Pelexam and Sulfur take the same trend at the previously mentioned days and had no effect in reducing the population of L. trifolii .

From the obtain allover mean reduction percentages of leafminer population, it could be noticed that there are high significant differences in leafminer population through the used compounds as F test and L.S.D values were 6.20 and 2.05 respectively. Transform treatment had significantly the highest reduction (63.54%) followed significantly by treatment of Vertimec (61.17%). Acetakel and Pelexam had low effect in reducing the population of L.trifolii 43.81 and 30.24%, respectively. Sulfur compound had no effect in reducing the population density of L. trifolii infesting snap bean plants. These results are in agreement with those obtained by Sharma et al (2003) who tested 7 insecticides against pea leafminer, Phytomyza atricornis (Chromatomyia horticola) on pea plants. Cypermethrin, fenvalerate, dimethoate, dichlorvos, methyl demeton, endosulfan and phosphamidon. Insecticides were significantly reduced the mean number of leaf miner population and increased the green pod yield compared to untreated control. Among the insecticides, fenvalerate, methyl demeton dimethoate found to be more effective in controlling leafminer population in both studied years compared to untreated control. The highest green pod yield were 54.49 and 42.49 q/ha at fenvalerate and methyl demeton, treatments respectively.

Abdou, et al. (2015) revealed that I conjesta had more sensitivity tested insecticides than 4. craccivora. Acetamiprid was the most effective against A. craccivora followed by chlorpyrifos, while emamectin benzoate was not effective. Abd-Ella, (2014) indicated that neonicotinoid insecticides were highly effective against cowpea aphid under field laboratory conditions.

Abd- Allah (2010) evaluated four chemicals: Thiocyclam, Bensultap, Imidaclopride and Imidaclopride on three snap bean cultivers and found Bensultap at recommended rate reduced the population of T. urticae and O. phaseoli on Giza 6 variety and Thiocyclam and imidaclopride caused the lowest reduction in mite and beanfly populations attacking Bronco variety Baloda et al (2003) studied the efficiency of six different insecticides; moncrotophos, phosphamidon, dimethoate, pyrethrum, neem extract and methyl–demeton against the pea aphids on fenugreek (Trigonella foenum graecum L). All the insecticidal treatments, significantly reduced aphid population compared with the untreated one. Similarly, all insecticidal treatments were superior over the control in increasing, the yield of the fenugreek, with maximum yield (8.95 q/ha) in plots treated with dimethoate.

Table 2. Pre-and post-treatment counts of aphids/10 leaflets and the corresponding reduction percent induced by the treatment of five compounds throughout 2020 at Qalyubia Governorate.

Compounds		Numbers /10 leaflets and reduction %							Mean
		Pre-treatment	After 1 day	3 days	5 days	7 days	11 days	14 days	
Transform	T	188.60	4.35	4.20	3.00	8.60	6.80	0	4.49
	R%		97.76^{a}	97.94^{a}	98.57^{ab}	95.95^{b}	99.97^{a}	100^{a}	98.37^{a}
Acetakel	T	246.00	33.20	8.60	10.55	13.70	8.90	0	12.49
	R%		86.87^{b}	96.77^{a}	96.13^{b}	95.17^{b}	96.88^{b}	100^{a}	95.30^{b}
Pelexam	T	189.40	41.20	7.00	8.25	10.20	12.75	8.40	14.63
	R%		78.84^{c}	96.58^{a}	96.07^{b}	95.22^{b}	94.20^{b}	96.29^{b}	92.87^{b}
Vertimec	T	200.60	184.40	0	0	0	4.85	9.60	32.04
	R%		10.58^{e}	100^{a}	100^{a}	100^{a}	97.92^{b}	99.96^{a}	84.54^{c}
Sulfur	T	192.20	78.40	122.80	185.95	204.80	165.20	178.60	155.96
	R%		60.32^{d}	40.94^{b}	12.81^{c}	5.48^{c}	25.95^{d}	22.31^{c}	27.97^{d}
Control		**180.25**	**185.30**	**195.00**	**200.00**	**203.20**	**209.25**	**215.60**	**201.39**
F			**18.4**	**25.8**	**31.4**	**26.8**	**21.9**	**13.7**	**10.81**
L.S.D.			**5.5**	**5.2**	**3.55**	**3.90**	**2.01**	**3.3**	**2.95**

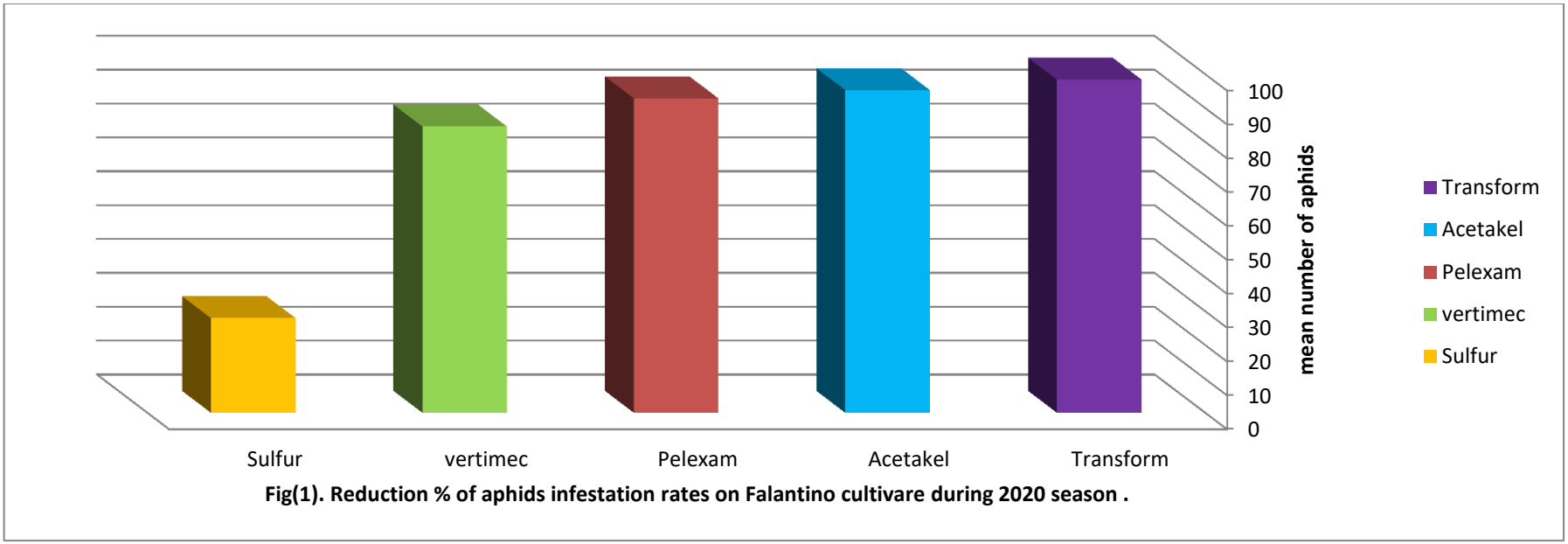
T= Total number / 10 leaflets
R%= Reduction percentage

Table 3. Pre-and post-treatment counts of *L.trifolii* /10 leaflets and the corresponding reduction percent induced by the treatment of five compounds throughout 2020 at Qalyubia Governorate.

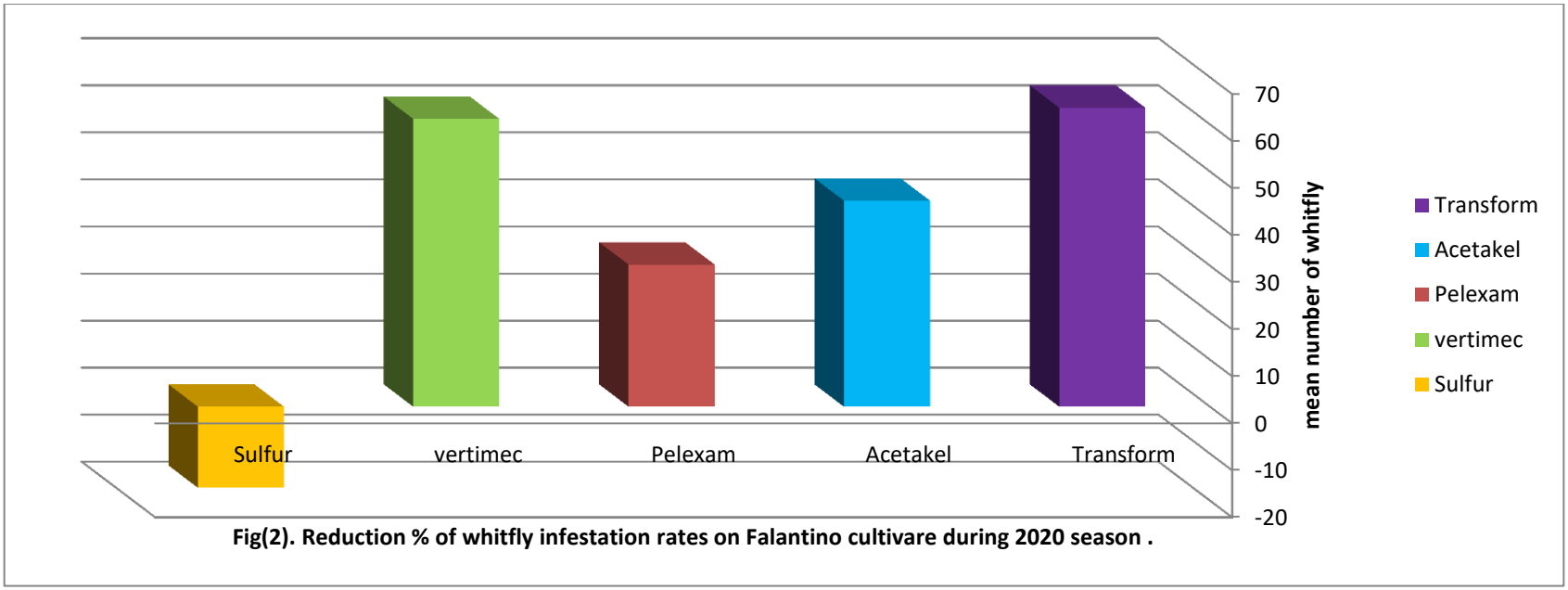
Compounds		Numbers /10 leaflets and reduction %							Mean
		Pre-treatment	After 1 day	3 days	5 days	7 days	11 days	14 days	
Transform	T	40.00	38.40	25.20	20.75	10.00	5.95	0	16.72
	R%		9.76[b]	44.83[b]	56.11[b]	80.98[b]	89.56[a]	100[a]	63.54[a]
Acetakel	T	47.60	37.00	35.20	35.00	33.00	30.00	31.20	32.56
	R%		26.93[a]	35.24[c]	37.79[c]	42.26[c]	55.75[c]	56.47[b]	43.81[c]
Pelexam	T	38.40	37.60	36.80	36.00	36.40	55.00	92.80	32.97
	R%		7.96[b]	16.07[d]	20.69[d]	27.88[d]	-0.56[d]	-60.48[c]	30.24[d]
Vertemic	T	35.20	37.80	13.80	8.00	6.20	10.80	29.00	17.60
	R%		0.94[c]	65.67[a]	80.77[a]	86.45[a]	78.46[b]	54.72[b]	61.17[b]
Sulfur	T	46.20	55.2	55.8	60.25	71.00	75.85	99.40	69.58
	R%		-12.31[d]	-5.78[e]	-10.33[e]	-16.92[e]	-15.26[d]	-42.87[c]	- 17.25[e]
Control		42.30	45.00	48.30	50.0	55.60	60.25	63.70	52.16
F			12.7	15.2	19.8	22.5	15.62	14.2	6.20
L.S.D.			3.9	5.9	5.6	4.9	5.2	4.6	2.05

T= Total number / 10 leaflets

R%= Reduction percentage



Fig(1). Reduction % of aphids infestation rates on Falantino cultivare during 2020 season .



Fig(2). Reduction % of whitfly infestation rates on Falantino cultivare during 2020 season .

Conclusion

From the results of current study, Transform, Acetakel and Pelexam gave the best results in reducing the population density of aphids (mainly Aphis gossypii, Myzus persicae and A. craccivora) infesting snap bean crop. Transform treatment had significantly the highest reduction followed significantly by Vertimec. Acetakel and Pelexam which had low effect in reducing the population of L.trifolii. Sulfur compound had no effect in reducing the population density of L. trifolii infesting snap bean plants.

References

Abd-Ella, A.A.(2014): Toxicity and persistence of selected neonicotinoied insecticides on cowpea aphids *Aphis craccivora* Koch (Homoptera: Aphididae). Archives of Phytopathology and Plant Protection;2014.47(3):366-376.

Abdou,G.Y.;Shalby,S.E.M.;Ebadah,I;Moawad,S. S.;MareiS.S.(2015): Efficancy of some low toxicity insecticides against som faba bean pests with special reference to chlorpyrifos residues. Journal of Entomological Research; 2015.39(1):31-38.

ABD – ALLAH, ATEF A. A. (2010): Trial for rational chemical control of red spider mite and beanfly attacking three varieties of the bean plants. Egypt. J. Agric. Res., 88 (1),

Baloda, R.S.; Lal, G. and Manohar, S.S. (2003): Efficacy of different insecticides against aphid, (*Acyrthosiphon pisum* H.) on fenugreek (*Trigonella foenum graecum* l.). J. Ecoph. 6(3/4): 107:111.

A. Abdou, Ekram; Refaei, E. A. and Taha, R.A. (2019) Field evaluation of insect pests infesting *Phaseolus vulgaris* and their natural enemies in Beheira Governorate. Egypt. J. Plant Prot. Res. Inst. 2 (3): 514 – 525

FAOSTAT 2001. Internet http://apps.fao.org. Flores, M., Mavingui, P., Perret, X., Broughton, W.J., Romero, D., Hernandez, G., Davila, G., and Palacios, R. 2000. Prediction, identification, and artificial selection of DNA rearrangements in Rhizobium: towards a natural genomic design. Proceedings of the National Academy of Sciences of USA 97: 9138–9143

Gepts, P.; Francisco, A.; Everaldo, G.D. and Blair, M.W. (2008): Genomic of tropical crop plants, 113-143.

Henderson, C.F. and Tilton, W.A. (1955): Test with acaricides against the wheat mite. J. Econ. Ent. 49: 157-161.

SAS Institute (2003): SAS Version 9.1. SAS Institute Inc., Cary, NC.

Satar, G., & Uygun, N. (2012). The effects of various temperatures on development and fecundity of Scymnus subvillosus (Goeze)(Coleoptera: Coccinellidae) feeding on Aphis gossypii Glover (Hemiptera: Aphididae). Türkiye Biyolojik Mücadele Dergisi, 3(2), 169-182.

Singh, S.P. and Schwartz, H.F. (2011): Review: Breeding common bean for resistance to insect pests and nematodes. Can. J. Plant Sci., 91: 239-250

Shahein, A. and El–Maghraby, M. M. A. (1988): Studies on the hymenopterous parasitoids of *Liriomyza trifolii* (Burgess) (Dipt., Agromyzidae) on broad beans in Egypt. J. App. Entomol., 106: 377–380.

Sharma, V.K.;. Arora R.K,. Singh, K. and Gupta, A. (2003): Relative efficacy and economics of some insecticides against leaf miner, *Phytomyza atricornis* (Meign) on pea. Ann. Biol., 19(1): 99-102.

Shehata, S. A; Ahmed, Y. M., Shalaby, E. A., & Darwish, O. S. (2011). Influence of compost rates and application time on growth, yield and chemical composition of snap bean (Phaseolus vulgaris L). Australian Journal of Basic and Applied Sciences, 5(9), 530-536.

تخفيض الكثافة العددية لحشرتى المن وصانعة الانفاق اللتان تصيبا محصول الفاصوليا بإستخدام بعض المبيدات ذو المواد الفعالة المختلفة

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تم اجراءالتجربة بمزرعة بقريةالسفاينة– طوخ محافظة القليوبية لدراسة تاثير خمس مركبات كيماوية على تعداد حشرات المن وصانعة الانفاق على نبات الفاصوليا صنف فالنتينو خلال 2020 .

اوضحت النتائج المتحصل عليها ان المبيد ترانسفورم واسيتاكيل وبلكسام سجلوا أعلى نسبة خفض وخفضت من الكثافة العددية لحشرة المن على نبات الفاصوليا اما بالنسبة لصانعات الانفاق اظهر كل من مبيد ترانسفورم وفيرتيمك اعلى نسبة خفض لصانعات الانفاق ، بينما اسيتاكيل وبلكسام اثرت بنسبة ضيئلة فى خفض الكثافة العددية لصانعات الانفاق على الجانب الاخر الكبريت لم يبدى اى تاثير فى خفض تعداد الحشرة من هذه النتائج المتحصل عليها يقترح ان تؤخذ فى الاعتبار عند تصميم برامج الادارة المتكاملة للافات فى حقول الفاصوليا .