EGYPTIAN ACADEMIC JOURNAL OF

BIOLOGICAL SCIENCES

F

TOXICOLOGY & PEST CONTROL

ISSN
2090-0791

WWW.EAJBS.EG.NET

Vol. 17 No. 2 (2025)

www.eajbs.eg.net

Citation: *Egypt. Acad. J. Biolog. Sci.* (F. Toxicology& Pest control) *Vol.17(2) pp129- 134 (2025)*
DOI: 10.21608/EAJBSF.2025.456782

Egypt. Acad. J. Biology. Sci., 17(2):129-134 (2025)

Egyptian Academic Journal of Biological Sciences
F. Toxicology & Pest Control
ISSN: 2090 – 0791

http://eajbsf.journals.ekb.eg/

Ecofriendly Management of the Main Insect Pests and Mites on Common Bean by Intercropping with Garlic and *Thyme*

Walaa, A. Tawfik and Elmesawy, M. G.
Plant Protection Research Institute, Agricultural Research Center, Dokki, Cairo, Egypt.
*E-mail: walaaabdelmoaty81@gmail.com

ARTICLE INFO
Article History
Received:26/8/2024
Accepted:3/10/2025
Available:7/10/2025

***Keywords*:**
Common bean, Garlic, Thyme, Sap-sucking pests, *Tetranychus urticae*, Leafminer.

ABSTRACT

One of the possible ways to preserve the ecosystem is through the diversity of natural enemies, reducing the seasonal abundance of harmful pests and increasing soil fertility, through the diversity of the agricultural ecosystem. Intercropping is one of the most important ways to preserve the environment. In this study, the impact of intercropping common bean (*Phaseolus vulgaris*) with garlic (*Allium sativum* L.) and wild thyme (*Thymus serpyllum*) was assessed on the density of sap-sucking pests, *Tetranychus urticae* and leafminer. Results revealed that intercropping improved the diversity of natural enemies and increased common bean productivity compared with the sole crop. Pest infestations were reduced significantly in both intercrops. In common bean intercropped with garlic, the infestations rates of *Bemisia tabaci*, *Empoasca decipiens* and *Aphis gossypii* were reduced to 13.21%, 5.71% and 3.75%, respectively. In common beans intercropped with thyme, the reductions were 7.14%, 13.75 % and 4.28% for pests mentioned before. Also, infestation by *T. urticae* decreased under intercropping conditions, recording 3.57% and 7.85% in common bean with garlic intercrop and in common bean with thyme, respectively compared to the sole common bean crop. These results demonstrate that intercropping common bean with garlic or thyme offers an effective strategy for managing important insect pests and improving crop productivity.

INTRODUCTION

Green bean (*Phaseolus vulgaris*) in Egypt is susceptible to several insect pests that can cause significant damage to both the quantity and quality of pods like aphids, leaf miners, leafhoppers, thrips and red spider mite which causes serious damage to plant (Abd El-Gawwad ,2008; Saleh, 2011). Integrated crop management (ICM) included some systems and methods which several agricultural practices can be linked and combined to reduce the reliance on chemical pesticides (Fathi 2022; Pandey *et al.,* 2023) to reduce the number of pests, as well as increase the occurrence of natural enemies of pests (Pandey *et al.,* 2023; Zarei *et al.,* 2019). To preserve natural enemies and increase relative abundance, intercropping is used by planting two or more crops in the same field at the same time (Midega *et al.,* 2018; Zakka *et al.,* 2018) through it, plants) throughout their growth period, or at least for part of their growing season (Ferreira *et al.*, 2014). One way to prevent pest population outbreaks and keep them below the level of economic damage is the intercropping system.

(Malik *et al*; 2003). This study refers to the role of intercropping common bean with garlic and thyme on occurrence of the main insect pests and their associated natural enemies.

MATERIALS AND METHODS

The experimental trials were conducted at Mansoura University Farm at Dakahlia Governorate during 2023. An area of about 800 m^2 was divided into four blocks, the experiments conducted based on a randomized complete block design with four blocks. Improved common bean (Giza 6) variety was used as the main crop intercropped with garlic (white local variety), thyme (*Thymus serpyllum*) and as well as Abamectine 1.8 % E.C. chemical pesticide was used as checks. The experiment was designed with four treatments in each treatment had four replications: sole common bean (control), common bean+ garlic, common bean + thyme and common bean + Abamectine 1.8% EC (chemical check). Each treatment consists of plot of land with 6 rows arranged with a row of common beans followed by another row of planting plants as follows: the first treatment is a row of common beans followed by a row of local garlic, the second treatment is a row of beans followed by arrow of wild thyme, the third treatment is 3 rows of beans sprayed with Abamectine benzoate 1.8%, while the fourth treatment is 3 rows of sole beans only as a control.

Data Analysis:

To reveal the apparent direct relationship between intercropping common bean with garlic, common bean with wild thyme and common bean sprayed with Abamectine benzoate 1.8% (chemical check) compared with sole common bean, in occurrence of insect pests. The percentage of infestation of insect pests and the percentage of reduction of *T. urticae* was calculated according to Henderson and Tilton (1955) as follows: $\%\ PR = \frac{c - t}{c} \times 100$

Where c, control; t, treatment and %PR= percent population reduction. The change in the annual Shannon diversity index (H) (Eq.1) of predator biodiversity was also calculated for all four treatments in the experiment. (Magurran 2004): $H = -\Sigma (Pi * In (Pi))$ (Eq.1).

Differences among treatment means were pared using one way analysis of variance (ANOVA). Comparisons of average numbers of pests between treatments were made with the Duncan's Multiple Range Test CoStat software statistical analysis system (CoStat Software, 2004) range test at 0.05 probabilities.

RESULTS AND DISCUSSION

A. Occurrence of Sap-Sucking Insect Pests on Intercropped Treatments Compared with Another Treatment:

The mean number and percentage of infestation for *B. tabaci, E. decipiens* and *A. gossypii* were estimated in (Table 1), they were significantly affected by the different treatments Meanwhile, the main infestation by *B. tabaci, E. decipiens* and *A. gossypii* were reduced on the intercropped common bean compared with the sole common bean. The lowest average population of *B. tabaci* was in treatment common bean with Abamectin1.8, followed by common bean with garlic (0.5 and 1.57), the lowest incidence of *B. tabaci* infestation was in the treatment that sprayed with a chemical pesticide followed by the intercropped common bean with garlic and with thyme compared to sole common bean (1.78, 3.21 and 7.14%). Also, the lowest percentage of infestation for *E. decipiens* and *A. gossypii* were in the treatment that sprayed with a chemical pesticide (3.57 and 1.07 % respectively) followed by the intercropped common bean with garlic (5.71 and 3.75 %) and with thyme compared to sole common bean (13.25 and 4.28 %).

Table 1: Population density of the major sap-sucking pests in the sole and intercropped common bean during 2023.

Treatment	Sap-sucking pests					
	Bemisia tabaci		*Empoasca decipiens*		*A Aphis gossypii*	
	Mean ±**S.E**	Infestation %	Mean ±**S.E**	Infestation %	Mean ±**S.E**	Infestation %
Sole common bean	7.28±1.76 a	21.42 %	23.5±**5.92** a	47.5 %	6.07±**1.46 a**	19.64 %
Common bean+ garlic	1.57±0.51 bc	3.21 %	3.57±**1.10** c	5.71 %	1.42±**0.38 bc**	3.75 %
Common bean+ Thyme	3.00±1.06 b	7.14 %	6.42±**1.38** b	13.57%	2.5±**0.78 b**	4.28 %
Common bean+ Abamectine 1.8	0.5±0.20 c	1.78 %	1.28±**0.45** d	3.57%	0.35±**0.19 c**	1.07 %
P-valu	0.0001***	------	0.0000***	<0.001	0.0002***	-------
LSD	0.05=1.630		0.05=1.88		0.05=1.63	

Mean value with the same letters is not significantly different at 0.05 level of significance.

B. Occurrence of Leaf Miner on Intercropped Treatments Compared with Other Treatments:

The percentage of infestation by the leaf miner *O. phaseolii* and *L. trifolii* was reduced on the intercropped common bean compared by the sole common bean. The lowest average population of *O. phaseolii* and *L. trifolii* was in treatment common bean with Abamectin1.8 (1.57 and 1.71 individuals/ leaf, respectively) followed by common bean with garlic (5.14 and 4.64 respectively, (Table 2).

Table 2: Population density of Leaf miner in the sole and intercropped common bean during 2023.

Treatment	***Ophiomyia phaseolii***		***Liriomyza trifolii***	
	Mean ±**S.E**	infestation %	Mean ±**S.E**	infestation %
Sole common bean	12.28±**1.59** a	55.35 %	12.14±**2.97** a	42.14%
Common bean+ garlic	5.14±**0.61** c	13.92 %	4.64±**0.91** c	8.57%
Common bean+ Thyme	7.64±**0.99** b	14.28 %	6.78±**0.96** b	12.50%
Common bean+ Abamectine 1.8	1.57±**0.49** d	3.57 %	1.71±**0.41**d	4.28%
P-value	0.0000***	-------	0.0000***	---------
LSD	0.05=1.882		0.05=1.882	

C- Occurrences of *T. urticae* on intercropped treatments compared with other treatments:

From the data in (Table 3) there were significantly affect in average number of *T. urticae* and the percentage of infestation between the treatments, the percentage of infestation was reduced on the intercropped common bean compared by the sole common bean it was 3.57% in common bean with garlic and 7.85% in common bean intercropped with Thyme. The Data in (Table 3) clearly indicated that populations of *T. urticae* were significantly higher on Common bean grown alone than when grown with either garlic or thyme with reductions 88.88 - 90.70 % in population density.

Table 3: Population density of *T. urticae* in the sole and intercropped common bean during 2023.

Treatment	***Tetranychus urticae***		
	Mean ±**S.E**	infestation %	PROC (%)
Sole common bean	43.92±**17.34** a	57.85 %	--------
Common bean+ garlic	2.00±**0.56** bc	3.57 %	90.70%
Common bean+ Thyme	3.14±**0.86** b	7.85 %	88.88%
Common bean+ Abamectine 1.8	0.78±**0.29** c	2.14%	96.90%
P-value	0.0000***	--------	-------
LSD	0.05=1.630		----------

Mean value with the same letters is not significantly different at 0.05 level of significance.
PROC (%), Population reduction over control

D- Occurrences of Predators on Intercropped Treatments Compared with Other Treatments:

The data in (Table 4) indicated a highly significant difference between treatments in the presence of predators, except for the treatment with the synthetic insecticides Abamectine 1.8., there was a highly average in the abundance of *Orius insidiosus* in common bean intercropped with garlic and with Thyme 11.85 and 9.0, respectively. The result also indicated that the *Coccinella undecimpunctata* had a highly significant population in treatments where common bean intercropped with garlic and with Thyme, compared to beans alone.

Table 4: Population abundance of predators in the sole and intercropped common bean during 2023

Treatment	*Nesidiocoris tenuis* Mean ±**S.E**	*Chrysoperla Carne* Mean ±**S.E**	*Orius insidiousus* Mean ±**S.E**	*Coccinella undecimpunctata* Mean ±**S.E**
Sole common bean	0.50±**0.35 b**	4.92±**1.09 b**	7.64±**2.17 b**	5.50±**1.34 b**
Common bean+ garlic	7.28±**0.57 a**	9.5±**1.44 a**	11.85±**2.10 a**	8.28±**1.08 a**
Common bean+ Thyme	7.07±**1.19 a**	6.21±**0.95 b**	9.0±**1.85 b**	7.28±**1.01 a**
Common bean+ Abamectine 1.8	-------	-------	0.42±**0.25 c**	0.50±**0.35 c**
P-Value	0.0001***	0.0035**	0.0000***	0.0000***
LSD	1.631=0.05	0.05=	0.05=1.63	0.05=1.63

The Shannon diversity index (H') for the community composition of common bean - dwelling predators per plant was significantly higher in two intercrops treatments than in sole common bean in 2023 concerning no significant difference in insecticides Abamectine 1.8 (Fig.1).

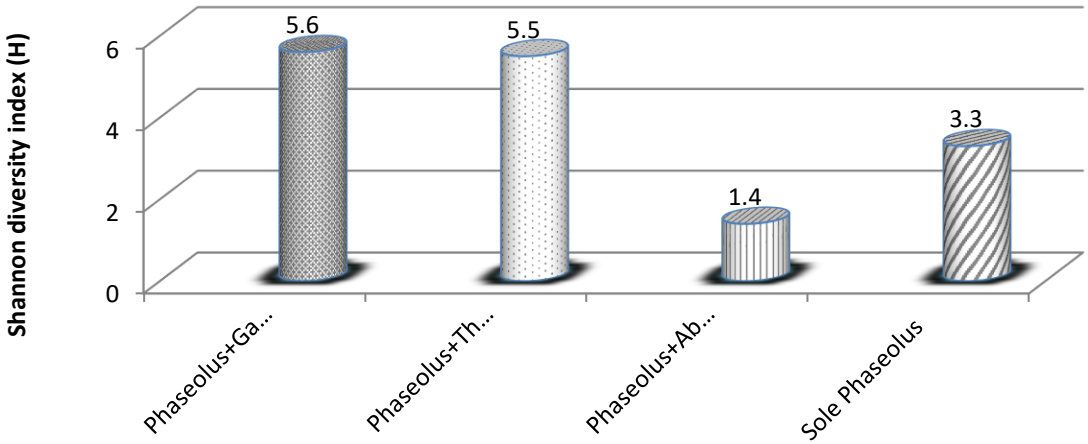

Fig.1. Intercropping effect on Shannon diversity index of common bean dwelling predators.

The results revealed that intercropping common bean with garlic and with thyme indicated that they were effective in attracting many general predators, especially *N. tenuis, C. Carne, O. insidiosus and C. undecimpunctata* that resulted in enhanced biological control. These results are in agreement with Mohamed, *et al.* (2021) who noted that the decrease in the number of pea pods infected with *E. zinckenella* was a result of intercropping peas with garlic compared to planting peas alone for both seasons of agriculture for all varieties. One of the methods of controlling pest population outbreaks and keep it below the economic damage, also reduces dependence and minimizes the reliance on pesticides through the intercropping system and increases the sustainability of agro ecosystems (Midega *et al,* 2018; Zakka *et al.,* 2018 and El -Wakeil *et al.,* 2020). Intercropping with non -preferred hosts reduces the damage caused by pests due to the pest's inability to discriminate between volatile substances emitted by the host plant and disrupt host plant finding (Finch and Collier, 2000).

Declarations

Ethical Approval: Not applicable.

Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally, and have read and agreed to the published version of the manuscript

Funding: This research received no specific grant from any funding agency in the public, commercial, or not for profit sectors.

Availability of Data and Materials: All datasets analyzed and described during the present study are available.

Acknowledgment: Not applicable.

REFERENCES

Abd El-Gawwad, S. A.Y. (2008). Study of integrated pest management on some pests of common bean plant Ph. D. Thesis, Zoology Department, Faculty of Science of Girls, Al-Azhar Univ., 409pp.

Costat Software. 2004 .Microcomputer program analysis, Version 4.20, CoHort Software, Berkely, CA, USA.

El-Wakeil, N., Saleh, M. M. E., Gaafar, N. M.F. and Elbehery, H. A. (2020). New aspects and practices of biological control conservation. *Mitteilungen der Deutschen Gesells chaft für Allgemeine und Angewandte Entomologie*, 22: 39-44

Fathi, S. A. A. (2022). The role of intercrops of eggplant and cowpea on the control of *Leucinodes orbonalis* Guenee(Lepidoptera: Crambidae). *Biocontrol,* 67: 307-317.

Finch, S. and Collier, R. H. (2000). Host -plant selection by insects -a theory based on "appropriate/inappropriate landings" by pest insects of cruciferous plants. *Entomologia Experimentalis et Applicata,* 96(2): 91 - 102. https://doi.org/10. 1046/j. 1570 -7458. 2000.00684.x

Ferreira, R. B., Teixeira, I. R., Reis, E. F., Silva, A. G. and Silva, G. C. (2014). Management of top-dressed nitrogen fertilization in the common bean/castor intercropping system. *Australian Journal of Crop Science,* 8(7): 1086-1092.

Hendrson and Tilton. (1955). Tests with acaricides against the brown wheat mite .Journal *of Economic Entomology,*38: 157,.

Magurran A, E. (2004) Measuring biological diversity. Blackwell Publishers, Oxford, UK.

Malik, M. F., Nawaz, M. and Hafeez, Z. (2003). Inter and intra row spacing effect on thrips Thrips spp. population in onion Allium cepa. *Asian Journal of Plant Sciences,* 2(29): 713715. doi: 10.3923/ajps.2003.713.715.

Midega, C. A. O., Pittchar, J. O., Pickett, J. A., Hailu, G. W. and Khan, Z. R. (2018). A climate adapted push-pull system effectively controls fall armyworm, *Spodoptera frugiperda* (J E Smith), in maize in East Africa. *Crop Protection,* 105: 10-15 https://doi.org/10. 1016/j.cropro.2017.11.003.

Mohamed, H. E.., Badawy, A. S.., Safaa, M. Abdel-Aziz and H.M. K.H. El-Gepaly (2021).Effect of peas and Garlic Intercropping on population density of some pests in Sohag Governorate.*Journal of plant production, Mansoura Univ.,* Vol. 12(2):179-186.

Pandey, M., Bhattarrai, N., Pandey, p., Chaudhary, p., Katuwal D.R.,Khanal, D. (2023). A review on biology and possible management strategies of tomato leaf miner, *Tuta absoluta,* Lepidoptera: Gelechiidae in Nepal. *Heliyon,* 9:e 16474.

Saleh, F. M. (2011). Effect of certain agricultural practices and biological control on soygreen bean pesrs. Ph.D. Theesis, Economic Entomol. Department, Faculty of Agric., Mansoura univ., 219pp.

Zakka, U., Chinaru Nwosu, L., and Peace Nkue, L. (2018). Effectiveness of maize as an intercrop in the management of insect pests of okra: Is there a better intercrop pattern than random intercrop practiced by farmers? *Journal of Crop Protection,* 7 (1): 65-72 doi: 10.13140/RG.2.2.36503.73126.

Zarei, E., Fathi, S. A. A, Hassanpour, M., and Golizadeh, A. (2019). Assessment of intercropping tomato and sainfoin for the control of Tuta absoluta (Meyrick). *Crop Protection,* 120: 125-133. doi: 10.1016/j. cropro.2019.02.024.