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Influence of some climatic factors and phytochemical components on the population density of main pests infesting common bean *Phaseolus vulgaris*

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Abstract
The study was conducted during two successive seasons 2019 and 2020 at Giza Governorate to evaluate the effect of some climatic factors (mean temperature and mean relative humidity) and phytochemical contents (nitrogen, phosphorus and potassium) on the population densities of principle pests, *Bemisia tabaci* (Genn.), Aphids (*Aphis craccivora* (Koch)*; A. gossypii* (Glover) and *Myzus persicae* (Sulzer)) and *Tetranychus urticae* Koch. In festing common bean plants *Phaseolus vulgaris* L. in Egypt. Results showed that the activity of *B. tabaci* recorded two peaks in September and October in the first season, while it recorded only one peak in September in the second season. Aphids and *T. urticae* recorded only one peak during the first season on October and September, respectively, whereas it was recorded two peaks in the second season during September and October for the first pest and September for the second one. The population densities of *B. tabaci* and Aphids correlated negatively with mean Temperature in the two studied seasons, this relation was significantly negative in case of aphids. On the other extreme the population densities of *T. urticae* related significantly positive with mean temperature. The population densities of *B. tabaci* and aphids correlated positively with relative humidity in the two studied seasons, while the population density of *T. urticae* affected negatively with relative humidity in the two seasons. The population density of the three studied pests affected with the phytochemical component of common bean leaves. *B. tabaci* and aphids were correlated significantly negative with nitrogen, phosphorus and potassium in the two studied seasons, while the relationship between *T. urticae* population and the three tested phytochemical components was insignificantly positive with nitrogen and significantly positive of phosphorus and potassium in the two seasons.
The combined effect (E.V. %) of climatic factors and phytochemical components on the population densities with the investigated pests was calculated separately and altogether using multiple regression analysis and showed that the combined effect of climatic factors on pest's population densities were (46.00% and 48.70%), for both seasons respectively, while the combined effect of phytochemical components were (37.00% and 39.00%) respectively, in the two seasons. The combined effects of climatic factors and phytochemical components altogether were 39.50% and 45.40% respectively, for two studied seasons indicating that the mean temperature and mean relative humidity & phytochemical components of leaves may play a more important role in affecting on the population densities of the studied pests and this information's can aid in the development of integrated pest management (IPM) of common bean plants.

Keywords: common bean (*Phaseolus vulgaris* L.), pests, phytochemical components, climatic factors

Introduction
The common bean (*Phaseolus vulgaris* L.) is one of the most important legumes worldwide because of its high commercial value, extensive production, consumer use and nutrient values, (Povic *et al.*, 2012) and (Taminaw and Eman, 2021). The common bean provides vital nutrients such as high starch, protein and dietary fiber and is an excellent source of minerals and vitamins as a legume it provides nitrogen and other soil health (Arulbalachandran and Mullainathan, 2009 and Frank *et al.*, 2018).
Common bean production in Africa suffers from different constraints. The main damage is caused by insect pest infestations in the field (Mwanauta *et al.*, 2015). In Egypt common bean usually infested by several pests that cause a considerable damage in both quantity and quality of pods, viz aphids [mainly *Aphis craccivora* (Koch) and *Aphis gossypii* (Glover)]; leaf miners [*Liriomyza trifolii (Burgess)*] onion thrips (*Thrips tabaci* Lind); leaf hopper (*Empoaca* spp.) and red spider mite [*Tetranychus urticae* (Koch)] which causes serious damage to plant and subsequently yield (Ogecha *et al.*, 2019; Ekram *et al.*, 2019 and Ashraf *et al.*, 2021)**.**
Many researchers studied the effect of climatic factors and phytochemical components on the infestation of certain insects infesting leguminous plants has been done previously, Hussein *et al.*, (2010); Abdel Hamed *et al.*, (2011); Omaprakash and Raju (2014); Ali *et al.*, (2015); Gamila *et al.*, (2016); Shaalan and Maha (2016); Aziza Abou-Zaid *et al.*,(2019) and Shah *et al.*, (2019).
The objective of this study is to evaluate the effect of climatic factors (mean temperature and mean relative humidity) on the infestation rates of certain common bean pests, whitefly, aphids and red spider mite and also

study the effect of some phytochemical components on the population density of the same pests and finally study the combined effect of climatic factors and phytochemical components separately and altogether to utilize the obtained results in the developing the integrated pest management (IPM) programs against these pests on common bean plants.

Materials and methods

These experiments were carried out during two successive seasons (2019 and 2020) to study the effect of both climatic factors and phytochemical components on the population density of main pests on common bean plants at Werdan village, Giza Governorate, Egypt. An experimental area of about 1050 m^2 was divided in to three replicates of 350 m^2 for each replicate. An experimental area was distributed according to a randomized complete block design and sown by common bean seeds (*Phaseolus vulgaris* L.) variety Neprasca on 1st week of August (Aug., 1st) in both seasons. Randomized samples were taken when the age of plants reached about 21 days and for 10 weeks. These points were studied as followed by:

1. Sampling techniques

Samples of 10 leaflets (10 leaflets x 3 replicates) were taken early in the morning and transferred to the laboratory in the same day for investigated and counting the numbers of certain pest [*B. tabaci*; Aphids (*A. craccivora, A. gossypii* and *M. persicae)* and *Tetranychus urticae* by aid of a stereomicroscope.

2. Influence of some climatic factors (Mean temperature and mean relative humidity) on the population density of three studied pests.

Daily mean temperature and mean relative humidity for both studied seasons were obtained from Central Laboratory for Agriculture Climate. The mean numbers of the previously mentioned pests were statistically analysis by simple correlation and partial regression to show changes in the population densities of the studied pests and its relation to these two factors.

3. Relationships between some phytochemical components in leaves of common bean leaves and population density of certain pests.

The analysis of leave samples were conducted in Department of insect Physiological, Plant Protection Research Institute, Agricultural Research Centre to determine certain phytochemical components in dry leaves of common bean to explain the relationship between present of different leave components (nitrogen, phosphorus and potassium) and infestation with the studied pests during the plant growth period (Seedling, flowering and fruiting stages).

Statistical analysis was conducted by using SAS program (2003). F test, simple correlation and partial regression were used. Also the difference between means per 10 leaflets was conducted by using Duncan's multiple range tests in this program.

Results and Discussion

1. Population abundance of the main pests infesting common bean plants *Phaseolus vulgaris*.

1.1 Whiteflies *B. tabaci*.

In the first season 2019 (Table 1) the population density of *B. tabaci* appeared in few numbers on common bean plants from the beginning of inspection period and then it highly increased to reach the first peak of abundance on September 29th, with mean number of 76.00 individuals/ 10 leaflet. After that the population decreased on the beginning of October and then increased to reach the second peak on October 20th (45.00 individuals/ 10 leaflets). The population density of *B. tabaci* during the second season 2020 (Table 2) fluctuated from the low abundance from the last week of August to reach the highest peak of 72.00 individuals/ 10 leaflet during the third week of September (Sep., 22nd), then the population decreased gradually till the end of inspection period.

1.2 Aphids (mainly *A. craccivora, A. gossypii* and *M. persicae)*.

It is evident from Tables 1 and 2 that the mean numbers of aphids during two studied seasons 2019 and 2020 appear with few numbers showing 12.00 and 11.00 individuals/ 10 leaflet respectively and fluctuated up to down until the end of the two studied growing seasons, two peaks were recorded during two studied seasons at the same time, Sep., 15th and Oct., 20th with mean numbers 74.00 and 46.00 & 114.00 and 99.00 individuals/ 10 leaflet, respectively.

1.3 Red spider mite *T. urticae*.

Data presented in Tables 1 and 2 revealed that the population density of *T. urticae* was less during the first season than the second one with mean numbers 37.70 and 53.90 individuals/ 10 leaflets during two seasons 2019 and 2020 respectively. In the first season the activity period of *T. urticae* expressed by one peak which found on the beginning of Sep., 1st being 72.00 individuals/ 10 leaflets. On the other extreme, the population density recorded two peaks during the second season 2020, the first peak occurred in the beginning of September (Sep., 1st) (98.00 individuals/ 10 leaflets), while the second one occurred in the second week of September (Sep., 1st) with mean numbers 83.00 individuals/ 10 leaflet.

Several author in different countries studied the population density of *B. tabaci*, aphids and *T. urticae*, El-Dash *et al.*, (2018) [8] detected that *A. craccivora* and *B. tabaci* on green bean fluctuated from the low abundance to reach the highest peak at October and September.
The seasonal abundance of *T. urticae* showed three peaks of population density in 2nd and 4th weeks of April and 1st week of June, while the population density of *A. craccivora* and *B. tabaci* on common bean plants showed two peaks in April and May for the first pest & May and June for the second one during two seasons (Gamila *et al.*, 2016) [11].

2. Influence of some climatic factors (Mean temperature and mean relative humidity) on the population density of certain pests infesting common bean plants.
Data presented in Table (3), showed the simple correlation (r) and explained variance % (E.V%) for relationship between the weekly mean temperature, weekly mean relative humidity and population density of pests [*B. tabaci*; Aphids (*A. craccivora, A. gossypii* and *Myzus persicae)* and *T. urticae* Koch.] infesting common bean plants *Phaseolus vulgaris* during two successive seasons 2019 and 2020.

2.1 Whiteflies *B. tabaci*.
The obtained results appeared that the correlation coefficient between population density of *B. tabaci* and mean temperature was insignificantly negative in the two studied seasons, as (r) values were -0.43 and -0.05, respectively (Table, 3). Whereas, the effect of relative humidity on the population of this pest was significantly positive in the 1st season (r value = 0.50). While, the population of *B. tabaci* in the second season, 2020 correlated slightly positive with R.H. (r value = 0.17).
The combined effect of climatic factors (mean temperature and mean relative humidity) on the population density of *B. tabaci* could be also detected through the calculated explained variance shown in Table (3). E.V% values were 22.30 and 25.90 % for the two seasons, respectively.

2.2 Aphids (*Aphis craccivora, A. gossypii* and *Myzus persicae*).
The obtained results of aphid population and relationship with phytochemical components took the same trend of the obtained results of *B. tabaci*. Data in Table (3) indicated that the effect of mean temperature on activity of aphids had highly significantly negative relationship between mean temperature and aphids population as (r values = -0.73 and -0.88) during two seasons receptively. Meanwhile, the relationship between the mean relative humidity and mean number of this pest had insignificantly positive (r values = 0.05 and 0.25 in both seasons, respectively).

Table 1: Weekly mean numbers of certain pests/ 10 leaflets infesting common bean leaves and corresponding mean temperatures, mean relative humidity and phytochemical component during season 2019, at Giza Governorate.

Inspection dates 2019	Number/ 10 leaflet			Climatic factors		Mean phytochemical components mg/ g dry wt., (Seedling, flowering and flowering+ fruiting)		
	B. tabaci	Aphids *(A. craccivora+ A. gossypii+ M. persicae)*	*T. urticae*	Mean Tem.	Mean R.H.	Nitrogen	Phosphorus	Potassium
Aug., 25th	8.00	12.00	48.00	28.31	53.38	70.10	2.40	20.55
Sept., 1st	6.00	18.00	72.00	30.23	55.98			
8th	0.00	34.00	68.00	29.78	60.19			
15th	5.00	74.00	52.00	28.60	58.46	56.30	2.14	10.60
22nd	40.00	53.00	44.00	28.14	46.93			
29th	76.00	81.00	27.00	27.89	48.99			
Oct., 6th	35.00	90.00	19.00	27.86	52.12			
13th	39.00	104.00	20.00	27.42	56.83	62.00	2.13	7.17
20th	45.00	114.00	18.00	27.43	59.92			
27th	29.00	87.00	9.00	24.55	62.99			
Mean	28.30[a]	66.70[b]	37.70[c]	28.02	55.58	62.80[c]	2.22[a]	12.77[b]
F. value	21.19			-		35.21		
Prob., F.	0.0001			-		0.0001		
L.S.D.	8.22			-		10.20		

The multiple regression analysis indicated that the combined effect (E.V.%) of these two factors together on the population density of aphids on common bean plants were 35.30 and 38.00% during two seasons 2019 and 2020, respectively (Table, 3).

2. 3 Red spider mite *T. urticae.*

According to the statistical analysis of the obtained data in Table (3), the mean numbers of *T. urticae* on both seasons 2019 and 2020 were high significant and positive correlated with mean temperature (r values = 0.87 and 0.94 in both seasons, respectively). On the other hand, the relative humidity had insignificant negative correlation with mean number of this pest (r values = -0.06 and -0.22, respectively for two seasons). The explained variance of mean temperature and mean relative humidity together on this pest was the highest effect in the first season (E.V. = 32.40%). Meanwhile, these two factors had low effect on the activity of *T. urticae*, in the second season (E.V.% = 27.00 %).

The combined effect of temperature and relative humidity on the population density of all studied pests infesting common bean plants *Phaseolus vulgaris* throughout the two tested seasons was strongly affected by 46.00 and 48.70 %, respectively for both seasons (Table, 3).

Table 2: Weekly mean numbers of certain pests/ 10 leaflets infesting common bean leaves and corresponding mean temperature, mean relative humidity and phytochemical component during season 2020, at Giza Governorate.

Inspection dates 2020	Number/ 10 leaflet			Climatic factors		Mean phytochemical mg/ g dry wt., (Seedling, flowering and flowering+ fruiting)		
	B. tabaci	Aphids *(A. craccivora+ A. gossypii+ M. persicae)*	*T. urticae*	Mean Tem.	Mean R.H.	Nitrogen	Phosphorus	Potassium
Aug., 25th	7.00	11.00	85.00	29.64	54.71	68.80	2.10	17.80
Sept., 1st	9.00	14.00	98.00	29.93	57.86			
8th	11.00	34.00	69.00	30.36	60.36			
15th	16.00	46.00	83.00	30.07	58.14	60.10	1.90	10.20
22nd	72.00	41.00	74.00	29.71	59.50			
29th	51.00	55.00	54.00	29.14	57.07			
Oct., 6th	45.00	78.00	37.00	27.93	56.71			
13th	38.00	93.00	26.00	27.43	58.64	64.10	1.89	7.30
20th	27.00	99.00	10.00	26.29	59.29			
27th	16.00	89.00	3.00	25.50	58.29			
Mean	29.20[a]	56.00 [b]	53.90 [b]	28.60	58.06	64.33[c]	1.96[a]	11.77[b]
F. value	28.60			-		33.70		
Prob., F.	0.005			-		0.0001		
L.S.D.	13.63			-		10.20		

Similar trends were found by Nitharwal and Kumawat (2009) [17] found a significant negative correlation of Jassid, whitefly and thrips with maximum temperature. Amal *et al.*, (2018) [3] indicated that whitefly density of reached a peak when the relative humidity was less than 65%. Khan *et al.*, (2020) [13] showed that the significant positive relationship between aphids population and temperature on bean plants. Mohamed *et al.*, (2021) [15] revealed that the effect of weather conditions on population density of *Aphis craccivora* were highly significant and also the mean daily minimum temperature were the most effective variable for the changes in the insect population infesting faba bean plants. The correlation between relative humidity and the infestation by *A. craccivora* was insignificantly positive.

3. Relationship between phytochemical components in leaves of common bean leaves and the population density of certain pests.

Table 4, showed mean counts of three studied pest species infesting leaves of common bean plants *Phaseolus vulgaris* in the two seasons (2019 and 2020) and the correlation coefficient value between these relative population densities and content of phytochemical component in the leaves.

Table 3: Relationship between climatic factors and population density of certain pests infesting common bean leaves *Phaseolus vulgaris* during two successive seasons, 2019 and 2020.

seasons	Tested factors		*B. tabaci*			Aphids			*T. urticae*			E.V.%
			Mean no.	r	E.V.%	Mean no.	r	E.V.%	Mean no.	r	E.V.%	
2019	Climatic factors	Mean Tem.	28.30	-0.43	22.30	66.70	-0.73	35.30	37.70	0.87	32.40	46.00
		Mean R.H.		0.50			0.05			-0.06		
2020	Climatic factors	Mean Tem.	29.20	-0.05	25.90	56.00	-0.88	38.00	53.90	0.94	27.00	48.70
		Mean R.H.		0.17			0.25			-0.22		

r = Correlation Coefficient factor
Mean no. = mean number of pest
E.V. % = Explained variance %

3.1 Whiteflies *B. tabaci*.

Statistical analysis revealed that there is a high significant negative correlation between the mean numbers of population and the different tested phytochemical components with r value of -0.89, -0.74 and -0.85 for nitrogen, phosphorus and potassium, respectively in the first season. In the second season, the results took the same trend as in the first season, the population density of *B. tabaci* correlated significantly negative with nitrogen (r = -0.87), phosphorus (r = -0.73) and potassium (r = -0.56).

The multiple regression analysis indicated that the combined effect (E.V %) of selected phytochemical components on the population density of *B. tabaci* were 41.00 and 48.00 % for both seasons, respectively (Table, 4).

3.2 Aphids (*Aphis craccivora+ A. gossypii+ Myzus persicae*).

With regard the statistical analysis for the effects of the three selected phytochemical components on the population density of aphids (*Aphis craccivora; A. gossypii* and *Myzus persicae*) during both seasons are given in Table (4). Results revealed that there is a highly significant negative relationship between the nitrogen, phosphorus and potassium & mean numbers of aphids, the calculated simple correlation (r) values for these relation were -0.54, -0.66 and -0.75, respectively for three phytochemical components in the first season.

In the second season, the same relations were detected for three studied factors, the population density of aphids was correlated highly significant negative with nitrogen (r = -0.73), phosphorus (r = -0.51) and potassium (r = -0.71).

The percentage of the explained variance (E.V.%) for three phytochemical component during two seasons were 48.00 and 61.00 % effects on the population density of aphids for seasons, respectively.

Table 4: Relations between phytochemical component in leaves of common bean and population density of certain pests infesting common bean plant *Phaseolus vulgaris* during two successive seasons 2019 and 2020.

seasons	Tested factors		*B. tabaci*			Aphids			*T. urticae*			E.V.%
			Mean no.	r	E.V.%	Mean no.	r	E.V.%	Mean no.	r	E.V.%	
2019	Phytochemical component	Nitrogen	28.30	-0.89	41.00	66.70	-0.54	48.00	37.70	0.40	42.00	37.00
		Phosphorus		-0.74			-0.66			0.77		
		Potassium		-0.85			-0.75			0.89		
2020	Phytochemical component	Nitrogen	29.20	-0.87	48.00	56.00	-0.73	61.00	53.90	0.06	35.00	39.00
		Phosphorus		-0.73			-0.51			0.54		
		Potassium		-0.56			-0.71			0.72		

r = Correlation Coefficient factor
Mean no. = mean number of pest
E.V. % = Explained variance %

Over all E.V. % (Physical factors and phytochemical components) in 2019 = 39.50
Over all E.V. % (Physical factors and phytochemical components) in 2020 = 45.40

3.3 Red spider mite *T. urticae*.

The obtained results of the relationship between the population density of *T. urticae* and phytochemical components were differed from the results of whitefly on aphids (Table, 4). In the first season 2019 the incidence of the *T. urticae* on common bean plants was high significantly positive correlated with phosphorus and potassium (r values = 0.77 and 0.89, respectively), while it was insignificantly positive correlated with nitrogen (r value = 0.40). In the second season 2020, the results took the same trend, the population density of this pest correlated significantly positive with phosphorus (r = 0.54) and potassium (r = 0.72) & insignificant positive with nitrogen (r = 0.06). The combined effects of three tested phytochemical component were 42.00 and 35.00% respectively, for two seasons.

The combined effects of all tested factors (mean temperature and mean relative humidity & nitrogen, phosphorus and potassium) on the population density of *B. tabaci*, aphids and *T. urticae* could be also detected through the calculated explained variance shown in Table (4). E.V.% values were 37.00 and 39.00% for two seasons, respectively.

Similar trend were found by Zaher, *et al.*, (1980) [25] recorded insignificantly positive correlation between *T. urticae* infestation and nitrogen content on soybean plants. Magouz *et al.*, (2006) [14] and El-Sanady *et al.*, (2008) [9] reported a negative correlation between the population density of *T. urticae* and nitrogen contents on soybean plant. These results are in disagreement with those obtained by Aziza Abou-Zaid *et al.*,2019 [6], indicated that a positive relationship was found between pests (*B. tabaci* and *T. urticae*) infestation and squash leaf contents *i.e.* nitrogen, total proteins, total carbohydrates and reducing sugar. In addition the effect of potassium content and total phenols was negative effect on the *B. tabaci* and *T. urticae* populations.

Finally, from the abovementioned results, it could be stated that the population density of *B. tabaci* increase by decreasing the mean temperature and mean relative humidity. With the increase in mean temperature, the

population of aphids decreases and the population of *T. urticae* increases. As the lowest population density of *B. tabaci*, aphids and *T. urticae* were associated with the high level of nitrogen, phosphorus and potassium.

References

1. Abdel Hamed NA, Shaalan HS, Yasin SA, Abou-Zaid AMM. Effect of some abiotic factors on the population fluctuation of some pests infesting okra plants, with the using of some compounds in their controlling. J. Plant Pro., and Pathol., Mansoura Univ,2011:2(4):407-420.
2. Ali Fatma S, Afifi AM, El-Saiedy EMA, Ahmed MM. Effect of phytochemical components, morphological and histological leaf structure of five tomato hybrids on *Tetranychus urticae* Koch. infestation. Acarines,2015:9:23-30.
3. Amal IS, Naiem EA, Abdel-Whab HA, El-Gendy KM. Population dynamics of the whitefly, *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) on common bean, *Phaseolus vulgaris* in relation to cultivar, temperature and humidity. Alexandria Sci., Exchange Journal,2018:39(2):296-306.
4. Arulbalachandran D, Mullainathan L. Changes on protein and methionine content of black gram (*Vigna mungo* L.) Hepper induced by gamma rays and EMS. American- Eurasian J. of Scientific Res,2009:4(2):68-72.
5. Ashraf W, Rather BA, Ayoub L, Wani FF, Gull A *et al*. Population dynamics of major insect pests of common bean in Kashmir vally. India J. of Entomology. No, 2021 e21051.
6. Aziza Abou-Zaid MM, Azza A, Mohamed El-Gepaly HMKH, Seham A, EzzEl- Dein. Response of squash varieties to *Tetranychus urticae* (Acari: Tetranychidae) and *Bemisia tabaci* (Hemiptera: Aleyrodidae) in festation in relation with its leaf chemical compositions. Egypt. J. plant prot. Res. Inst,2019:2(1):183-193.
7. Ekram A, Abdou EA, Refaei, Taha RA. Field evaluation of insect pests infesting Phaseolus vulgaris and their natural enemies in Beheira Governorate. Egypt. J. Plant Prot. Res. Inst,2019:2(3):514-52.
8. El-Dash AA, Kolaib MO, El-Dafrawy BM, Hossiny M Seasonal variation of the green beans aphid, *Aphis craccivora* Koch and its natural enemies on the green beans plants, *Phaseolus vulgaris* L. at Menoufia Governorate. Menoufeia J. Plant Prot,2018:3:93-98.
9. El-Sanady MA, Soliman SM, Younis AA. Field and laboratory studies to evaluated five soybean varieties for their relative susceptibility to the two spotted spider mite, *Tetranychus urticae* Koch infestation (Acarina: Tetranychidae: Actenidida). Egypt. J. Agric. Res,2008:86(1):77- 88.
10. Franke AC, Van-Den Brand GJ, Vanlauwe BM, Giller K. Sustainable intensification through rotations with grain legumes in Sub-Saharan Africa. Agric., Ecosystems & Environment,2018:261:172-18.
11. Gamila SH. Ismail SHA, Abd-Elsamad AA Population fluctuations of the main pests infesting kidney beans and its relation with some weather factors. Annals of Agric. Sci., Moshtohor,2016:54(4):969- 976.
12. Hussein SHA, Hanafy ARI, Maha AM Tantawy. Effect of cultivars, some climatic factors and plant developmental stages on the population density of onion thrips, Thrips tabaci Lind. on garlic plants in Egypt. Fayoum J. Agric. Res. & Dev,2010:24(1):30-36.
13. Khan AU, Choudhury MAR, Dash CK, Khan UHS, Elsanullah M. Insect pests of country bean and their relationships with temperature. Bangladesh J. of Ecol,2020:2(1):43-46.
14. Magouz RIE, Saadoon S, Kassem SAA: Population density of *Tetranychus cucurbitacearum* (Sayed) and *Bemisia tabaci* (Genn.) on certain soybean varieties in relation to some weather factors and leaf chemical contents. J. Agric. Tanta Univ,2006:32(1):90-102.
15. Mohamed S, Ghada ROH, Allam Heba AM, Bakry MMS. Impact of certain weather factors and plant ages on population density of *Aphis craccivora* (Koch) on fava bean plants in Luxor Governorate, Egypt. SVU. International J. of Agric. Sci,,2021:3(4):84-104.
16. Mwanauta RW, Mtei KM, Ndakidemi PA. Potential of Controlling Common Bean Insect Pests (Bean Stem Maggot (*Ophiomyia phaseoli*), Ootheca (*Ootheca bennigseni*) and Aphids (*Aphis fabae*)) Using Agronomic, Biological and Botanical Practices in Field. Agric. Sci,2015:6(5):489-497.
17. Nitharwal M, Kumawat KC. Population dynamics of insect pests of green gram [*Vigna radiate* (Linn.) Wilczek] in semi- arid region of Rajasthan. Indian J. of Applied Entomology,2009:2:90-92.
18. Ogecha JOW, Arinaitwe JW, Muthomi V, Aritua, Obanyi JN. Incidence and severity of common bean (*Phaseolus vulgaris* L.) pests in agro- ecological Zones and Farming systems of western Kenya. East African Agric., and forestry Journal,2019:83(3):191-205.
19. Omaprakash SO, Raju SVS. A brief review on abundance and management of major insect pests of brinjal (*Solanum Melongena* L.). Int. J. Appl. Biol. and Pharmaceutical Technol,2014:5(1):228-234.
20. Povic TM, Starovic G, Aleksi S, Zivkovic D, Josic, Ignjatov M. Response of different beans against common bacterial blight disease caused by Xanthomonas axonopodis PV. phaseoli. Bulgarian J. of Agric. Sci,2012:18(5):701-707.
21. SAS. SAS/ stat user's guide, 9.2. SAS Institute, Cary, NC., USA, 2003.
22. Shaalan HS, Maha S El-Ghanam. Effect of planting space, some weather factors and plant age on the population density of *Liriomyza trifolii* (Burgess) infesting pea plants. Egypt. Acad. J. Biolog. Sci,2016:9(3):21-30.
23. Shah MA, Sharma S, Sharma J. Bio-efficacy of potassium silicate against aphids and whitefly in potato. Potato J,2019:46(2):132-137.

24. Taminaw Z, Eman H. Review on effects of phosphorus fertilizer rates on growth, yield components and yield of common bean (Phaseolus vulgaris L.). J. of Current Research in Food Science,2021:2(1):34-39.
25. Zaher MA, Hanna MA, Mohamed II, Sawires ZR. Relative susceptipility of ten soybean varieties to mite infestation and probable causes resistance. Proc. 1st Conf. Plant Prot. Res. Ins,1980:3:41-51.