

INFLUENCE OF FERTILIZATION ON, MITE INFESTATION IN SOME EGGPLANT CULTIVARS, AND THEIR CHARACTERS

Abou El-Saad, A.K.* and Dalia M.T. Nassef**

*Plant Protection Research Institute, Agric. Res. Center, Dokki, Giza, Egypt.

**Vegetable Crops, Fac. Agric., Assiut Univ., Egypt.



ABSTRACT

Field studies were carried out at the Experimental Farm, Faculty of Agriculture, Assiut University, during two successive seasons 2014 and 2015 in early summer plantation to study the influence of chemical and bio-fertilizers on, infestation of eggplant cultivars, black balady; white balady and romy with the two-spotted spider mite, *Tetranychus urticae* Koch, and some of eggplant cultivars characters; growth vegetative and fruit characters.

Results indicated that *T. urticae* Koch started to appear with high mean numbers on eggplant cultivars in case of using chemical fertilizers (NPK) as compared with bio-fertilizers (Phosphorein and Nitrobein). The eggplant cultivars can be arranged according to the degree of infestation with *T. urticae* Koch as following white balady, black balady and romy, in either chemical or bio-fertilizers during the two seasons, 2014 and 2015.

Also, using the bio-fertilizers increased significantly the growth vegetative (plant height and number of branches) and fruit characters (fruit length, fruit diameter and fruit weight) in the two seasons of study.

According to mite infestation and the effect on the growth vegetative and fruit characters, bio-fertilizers may be recommend for use in eggplant varieties fertilization.

Keywords: eggplant – phosphorein – nitrobein – NPK – *Tetranychus urticae* – growth vegetative and fruit characters.

INTRODUCTION

Eggplant (*Solanum melongena* L.) is a common and popular vegetable crop grown in the subtropics and tropics. It is called brinjal in India, and in Europe aubergine. Eggplant is a perennial, but grown commercially as an annual crop. The name eggplant derived from the shape of the fruit of some cultivars, which are white and shaped very similarly to chicken eggs. Production of eggplant is highly concentrated with 85% of output coming from five countries, China is the top producer (56%) of world output and India is second (26%), Egypt (3.11%), Turkey (2.5%) and Indonesia (1.21%) (FAO, 2008).

The intensive use of expensive mineral fertilizers in recent years resulted in environmental pollution problems, and high rates or a long period decreased the potential activity of microflora and stability of soil organic matter. Bio-fertilizers are one of the most important materials required to substitute for chemical fertilizers for healthy cheap production (Abdel-Wahid, 2005).

The two-spotted spider mite, *Tetranychus urticae* Koch is considered a very important pest infesting eggplant and cause serious damage to the plant and yield (Hagrass *et al.*, 2008 and Hassan *et al.*, 2013).

Thus, the aim of the present work is to study the influence of chemical and bio-fertilizers on, infestation of eggplant cultivars with the two-spotted spider mite, *T. urticae*, also on some characters, growth vegetative and fruit of three eggplant cultivars; black balady, white balady and romy during two successive seasons 2014 and 2015, to serve these studies as a basis for using in integrated pest management programs.

MATERIALS AND METHODS

This work was carried out in the Experimental Farm, Faculty of Agriculture, Assiut University, during two successive growing seasons 2014 and 2015 in a

loam clay soil. An area of about 1/8 feddan was cultivated with three eggplant cultivars; black balady, white balady and romy. The experiment was conducted in complete randomized block design with three replicates 3x3.5 m (1/400 feddan). Seeds of each cultivar were sown in March 1st (2014 and 2015) for early summer plantation.

The fertilizers used were; ammonium sulphate (20% N), calcium super-phosphate (15.5% P) and potassium sulphate (48% K), Abdel-Wahid (2005). The plants were fertilized with NPK at the ratio of 1:1:1. Six grams of this fertilizer mixture were added to each plant of those received chemical fertilization.

The mixed bio-fertilizers (phosphorein and nitrobein) were supplied at 7.5 kg/fed the soil was irrigated, Shaalan (2005).

Phosphorein fertilizers, a commercial product that contains a specific strain of bacteria, *Bacillus megatherium* Bary, which changes the unavailable tri-phosphate to available mono-phosphate. It was obtained from the unit of bio-fertilizer, Agricultural Research Center, Giza, Egypt.

Nitrobein fertilizer containing strain of nitrogen fixing bacteria namely, *Azotobacter chroococcum* Cochran. The nitrobein strain was provided by the unit of bio-fertilizer, Agricultural Research Center, Giza, Egypt.

Other cultural practices were carried out according to the recommendations of Ministry of Agriculture except using any pesticides treatment. Sampling started after three weeks from planting and continued to the harvest time, continued each sample comprised (5) leaflets picked random representing the plant levels from each replicate. Samples were put in plastic bags and transferred to the laboratory in the same day for examination and counting the mobile stages of *T. urticae* by using stereoscopic-microscope. The following data were recorded; plant height in cm, number of branches, fruit length in cm, fruit diameter in cm and fruit weight in gm. All data obtained were

statistically analyzed according to Snedecor and Cochran (1990) and the means were compared by using Least Significant Difference (L.S.D.) at level 5%.

RESULTS AND DISCUSSION

I- Influence of fertilization on the mean numbers of *T. urticae* Koch infesting eggplant:

Data Tables (1 & 2) showed that the influence of chemical and bio-fertilizers on the mean numbers of *T. urticae* Koch on three eggplant cultivars; black balady, white balady and romy, during 2014 & 2015 growing seasons. In the first season, 2014, the mean numbers of mite/15 leaflets in chemical and bio-fertilizers

treatments were 15.69 and 12.08, 22.36 and 17.10, and 11.05 and 8.95 for black balady, white balady and romy varieties, respectively. In the second season, 2015, the corresponding means were (26.98 and 22.41), (33.6 and 28.87) and (14.97 and 12.21).

Concerning *T. urticae*, the population started to appear with few mean numbers 2.67 and 1.67, 3.67 and 3.00, 1.33 and 1.00 ind./15 leaflets on 22 March 2014 on black balady, white balady and romy eggplant cultivars in case of chemical and bio-fertilizers, respectively, then increased gradually reaching its maximum of 39.00 and 26.33, 52.00 and 39.00, 26.33 and 22.67 ind./15 leaflets on 24 May.

Table (1): Influence of chemical and bio-fertilizers on the mean numbers of *T. urticae* infesting eggplant cultivars during 2014 growing season.

Date	Cultivar & fertilizer	Black balady		White balady		Romy	
		Chemical	Bio-fertilizer	Chemical	Bio-fertilizer	Chemical	Bio-fertilizer
22/3/2014		2.67	1.67	3.67	3.00	1.33	1.00
29		3.00	2.33	5.00	4.33	1.33	1.33
5/4		4.00	3.00	7.33	6.33	1.33	1.33
12		5.67	4.67	9.00	7.33	3.00	2.33
19		7.33	5.33	12.00	10.67	3.33	2.33
26		9.00	7.00	15.67	13.00	6.00	4.00
3/5		13.67	10.67	16.33	15.00	10.67	9.00
10		21.33	18.33	26.67	22.33	15.67	12.00
17		31.33	21.67	45.33	32.67	24.67	21.33
24		39.00	26.33	52.00	39.00	26.33	22.67
31		27.67	23.67	41.33	29.67	18.33	15.00
7/6		21.67	17.33	32.67	18.25	17.33	13.00
14		17.67	15.00	23.67	20.67	14.33	10.67
G. Mean		15.69	12.08	22.36	17.10	11.05	8.95
L.S.D. 5%		2.029		2.981		1.189	

Table (2): Influence of chemical and bio-fertilizers on the mean numbers of *T. urticae* infesting eggplant cultivars during 2015 growing season.

Date	Cultivar & fertilizer	Black balady		White balady		Romy	
		Chemical	Bio-fertilizer	Chemical	Bio-fertilizer	Chemical	Bio-fertilizer
22/3/2015		4.00	2.67	5.67	5.00	2.00	1.67
29		6.67	4.00	10.00	8.67	3.33	2.67
5/4		10.00	8.33	13.67	12.33	5.00	4.67
12		13.00	12.00	19.67	16.33	8.00	7.67
19		20.00	16.67	25.00	24.00	11.00	9.00
26		25.33	20.67	32.33	25.00	16.00	12.00
3/5		28.67	24.00	40.33	35.00	18.33	15.00
10		34.67	28.33	46.33	40.67	21.33	16.67
17		45.67	41.00	55.00	44.33	25.00	21.00
24		54.00	46.00	62.00	56.00	28.33	23.33
31		40.67	36.33	48.33	44.00	21.67	19.33
7/6		35.67	27.67	40.67	35.00	19.00	14.00
14		32.33	23.67	34.67	29.00	15.67	11.67
G. Mean		26.98	22.41	33.36	28.87	14.97	12.21
L.S.D. 5%		2.568		2.433		1.462	

Also, the mean numbers of *T. urticae*, during the second season, 2015, started to appear with few 4.00 and 2.67, 5.67 and 5.00, 2.00 and 1.67 ind./15 leaflets on 22 March on black balady, white balady and romy eggplant cultivars in chemical and bio-fertilizers

treatment, respectively, then increased gradually reaching its maximum of 54.00 and 46.00, 62.00 and 56.00, 28.33 and 23.33 ind./15 leaflets on 24 May.

Generally, the mean numbers of *T. urticae*, during the two growing seasons took the same trend,

May was the most favourable month for mite activity. The three tested cultivars showed significant differences to infestation with *T. urticae*, white balady eggplant cultivar received the highest mean number of mites, followed by black balady and romy. The variation in eggplant cultivars may be due to antibiosis, morphological and physiological characters of the plant under using chemical and bio-fertilizers.

Based on the seasonal mean of *T. urticae*, significant variation between during the two seasons was recorded the second season 2015 was higher as compared with 2014 season, seems that the climatic factors may play an important role in abovementioned variation.

The present findings are in agreement and similar with those obtained by Ali *et al.* (2002) who found that black mulch was the most effective in decreased the mean numbers of the two-spotted spider mite on eggplant cvs., followed by white mulch plots, Taha *et al.* (2002) reported that, nitrogen fertilizer alone had considerable role in level infestation of two-spotted spider mite, *T. urticae* to peanut and sesame followed by mixture of N and K, while the opposite took place with adding potassium, alone, Afifi *et al.* (2004) found that in strawberry fertilization with CaSO₄ and K₂SO₄, reduced mite infestation and delayed it to the first half of March. These treatments led to an increase in total phenols and amino acids in both cultivars. The increased potassium level in the plant led to an increase in plant resistance to *T. urticae* infestation. Younes (2005) indicated that population density of the phytophagous mite, *Tetranychus cucurbitacearum* Sayed on five leaflets soybean increased significantly with nodulation, n-fertilization applied as ground or spray fertilization at 15 and 30 kg/fed., ground fertilization (30 kg/fed.) induced the highest increase in population, while spray fertilization (15 kg/fed.) caused the lowest number when compared with untreated check. Abou El-Saad (2010) found that, a higher infestation with two-spotted spider mite on the eggplant was in May. Mohamed (2013) reported that, the highest infestation with mite was recorded on balady cultivar and the moderate infestation was recorded on black stream beauty cultivar, while the lowest infestation was recorded on white cultivar.

II- Influence of fertilization on the some of eggplant characters:

Data in Tables (3 & 4) exhibited the influence of chemical and bio-fertilizers on the some of eggplant cultivars characters; the growth vegetative and fruit characters. The mean plant height in cm were (96.73 & 98.60), (102.07 & 103.20) and (79.67 & 81.13), and the mean number of branches were (3.87 & 4.13), (4.07 & 4.53) and (3.13 & 3.73) for black balady, white balady and romy cultivars when chemical and bio-fertilizers, respectively, during the first season 2014; (12.80 & 14.07 cm), (12.07 & 13.07 cm) and (8.40 & 9.47 cm) mean fruit length; (4.03 & 4.47 cm), (2.85 & 2.96 cm) and (6.91 & 7.80 cm) mean fruit diameter and (112 & 125 g), (99 & 103 g) and (200 & 229 g) mean fruit weight were recorded on black balady, white balady and romy eggplant cultivars in case of using chemical and bio-fertilizers, respectively, during 2014 growing season.

Similar results were in Table (4) which represented by (93.53 & 96.20 cm), (98.93 & 101.80 cm) and (77.93 & 79.00 cm) mean plant height; (3.47 & 3.80), (3.67 & 4.00) and (2.93 & 3.47) mean number of branches were recorded on black balady, white balady and romy eggplant cultivars during using chemical and bio-fertilizers, respectively, during the second season 2015. Also, the fruit characters which represented in Table (4) by (11.80 & 12.93 cm), (11.27 & 11.80 cm) and (7.53 & 8.80 cm) mean fruit length; (3.70 & 4.17 cm), (2.59 & 2.85 cm) and (6.79 & 7.25 cm) mean fruit diameter and (105 & 115 g), (97 & 100 g) and (194 & 217 g) mean fruit weight were recorded on black balady, white balady and romy eggplant cultivars in case of using chemical and bio-fertilizers, respectively, during 2015 growing season. It may be concluded that the bio-fertilizers, phosphorein and nitroben are defined as preparations containing living cells or latent cells of efficient strains of micro-organisms, *Bacillus megatherium* Bary and *Azotobacter chroococcum* Cochran, that help eggplant cultivars, uptake of nutrients by their interactions in the rhizosphere when applied through the soil, that cause significant increase in growth vegetative and fruit characters as compared with eggplant cultivars applied with chemical fertilizers.

Table (3): Influence of chemical and bio-fertilizers on the some of eggplant cultivars characters during 2014 growing season.

Character	Black balady			White balady			Romy		
	Chemical	Bio-fertilizer	L.S.D. 5%	Chemical	Bio-fertilizer	L.S.D. 5%	Chemical	Bio-fertilizer	L.S.D. 5%
* Growth vegetative character									
1- Plant height (cm)	96.73	98.60	1.631	102.07	103.20	1.095	79.67	81.13	1.353
2- Number of branches	3.87	4.13	0.249	4.07	4.53	0.431	3.13	3.73	0.581
* Fruit character									
1- Fruit length (cm)	12.80	14.07	1.255	12.07	13.07	0.902	8.40	9.47	1.021
2- Fruit diameter (cm)	4.03	4.47	0.425	2.85	2.96	0.102	6.91	7.80	0.792
3- Fruit weight (g)	112	125	4.955	99	103	3.852	200	229	7.235

Table (4): Influence of chemical and bio-fertilizers on the some of eggplant cultivars characters during 2015 growing season.

Character	Black balady			White balady			Romy		
	Chemical	Bio-fertilizer	L.S.D. 5%	Chemical	Bio-fertilizer	L.S.D. 5%	Chemical	Bio-fertilizer	L.S.D. 5%
* Growth vegetative character									
1- Plant height (cm)	93.53	96.20	2.129	98.93	101.80	2.581	77.93	79.00	0.941
2- Number of branches	3.47	3.80	0.295	3.67	4.00	0.304	2.93	3.47	0.512
* Fruit character									
1- Fruit length (cm)	11.80	12.93	1.016	11.27	11.80	0.468	7.53	8.80	1.111
2- Fruit diameter (cm)	3.70	4.17	0.443	2.59	2.85	0.231	6.79	7.25	0.398
3- Fruit weight (g)	105	115	4.399	97	100	2.689	194	217	5.738

These results agree with those reported by Gomaa (1989) who found that the combination of bio-fertilizers led to increase in plant growth, N, P, contents in the leaves, fruit yield and total dry weight of tomato plants than non-biofertilized control. He also added that inoculation tomato plants with mixture of nitrogen fixing bacteria and phosphate dissolving bacteria increased N and P contents in the leaves over inoculation with the nitrogen-fixing bacteria alone; Kushwah & Banafer (2003) reported that using phosphate solubilizing microorganisms had a significant role for stimulative the growth parameters of potato i.e. plant high, fresh and dry weights of shoots/plant. El-Shanafawi (2006) reported that bio-fertilizers significantly improved the vegetative traits of cucumber plants namely stem length, number of branches and number of leaves total. Abou El-Yazied and Selim (2007) found that *Bacillus megatherum* and *Azotobacter* sp. increased growth vegetative and yield in potato. Also, El-Shaikh *et al.* (2010) stated that applying bio-fertilizers to the soil and reducing nitrogen fertilizers increased the vegetative parameters of potato plants. The highest values of plant growth expressed as plant high, number of branches/plant, fresh and dry weights of sweet pepper/plant were obtained by the application of the *Azotobacter chroococcum* (El-Hifny & El-Sayed, 2011).

REFERENCES

- Abdel-Wahid, S.M.K. (2005). Effect of chemical and bio-fertilizers on *Cosmos sulphureus* Cav. Plants. II- Main constituents. Egypt. J. Agric. Res., 83 (2): 859-871.
- Abou El-Saad, A.K. (2010). Survey and population fluctuation of the piercing sucking pests inhabiting Solanaceous crops at Assiut Governorate. Fayoum J. Agric. Res. & Dev., 24 (2): 151-158.
- Abou El-Yazied, A. and S.M. Selim (2007). Effect of reducing N, P mineral fertilization levels combined with bio-fertilizer on growth, yield and tuber quality of potato plants. J. Agric. Sci., Mansoura Univ., 32 (4): 2957-2982.
- Afifi, A.M.; A.Y.M. El-Leithy; S.A. Shehata and E.W.M. El-Saidy (2004). Resistance of the strawberry plant to the two-spotted spider mite, *Tetranychus urticae* Koch. Third African Acarology Symposium, 1-15 January.
- Ali, G.; H.A. Hussien and N.A. Hafiz (2002). Effect of soil mulch used in off-season eggplant production on growth, yield and infestation with some common pests. 2nd Inter. Conf., P.P.R.I. Cairo, Egypt, 21-24 Dec.
- El-Hifny, I.M.M. and M.A.M. El-Sayed (2011). Response of Sweet pepper (*Capsicum annum* L.) plant growth and productivity to application of ascorbic acid and bio-fertilizers under saline conditions. Aust. J. Basic & Appl. Sci., 5 (6): 1273-1283.
- El-Shaikh, Kh.A.A.; Y.Y. Abdel-Ati; A.M. El-Damarany and A.A.H. Abdel-Lah (2010). Comparative study of three different fertilizers types on yield and tubers quality of potato grown in loamy sand soil. Zagazig J. Agric. Res., 37 (4): 857-874.
- El-Shanafawi, E.M. (2006). Effect of some bio-fertilizers on growth and productivity of cucumber plants growth under plastic house conditions. J. Agric. Sci., Mansoura Univ., 31 (1): 393-400.
- FAO (2008). Food and Agricultural and Organization of United Nations. Economics and Social Department, the Statistical Division.
- Gomaa, A.M.H. (1989). Bio-fertilizers and increasing of crop production. M.Sc. Thesis, Fac. of Agric., Cairo Univ.
- Hagrass, A.E.; M.E. El-Naggar; A.M. El-Naggar and W.M.R. Abou-Zeid (2008). Incidence of mites inhabiting some field crops in two localities at Dakahlia Governorate. Egypt. J. Agric. Res., 86 (1): 353-366.
- Hassan, M.F.; A.F. El-Bahrawy; G.A. El-Kady; R.I.A. Abo-Shnaf and M.S. Kamel (2013). Phytophagous mites and their natural enemies associated with common vegetables at Ismailia Governorate. Acarines, 7: 71-74.
- Kushwah, S.S. and R.N.S. Banafer (2003). Comparative study of chemical and bio-fertilizers on growth and yield of potato (*Solanum tuberosum* L.) cv. "Kufri". J. Yoti. Adv. Plant Sci., 16: 209-213.
- Mohamed, M.S.K.A. (2013). Predaceous mites as biological control agent for some agricultural pests of some vegetable crops in Ismailia Governorate. Ph.D. Thesis, Fac. of Agric., Suez Canal Univ.

- Shaalan, M.N. (2005). Effect of compost and different sources of bio-fertilizers on borage plants (*Borago officinalis* L.). Egypt. J. Agric. Res., 83 (1): 271-284.
- Snedecor, G.W. and G.W. Cochran (1990). "Statistical Methods" 8th ed. Iowa State Univ., Iowa, USA. Soil and Environ., 28 (2): 130-135.
- Taha, H.A.; S.A.A. El-Raies; S.M. Soliman and A.A.Ahmed (2002). Field studies on spider mite, *Tetranychus urticae* Koch as one of the main pests infesting oil crops. 2nd Inter. Conf., P.P.R.I. Cairo, Egypt.
- Younes, A.A. (2005). Population density of mites in soybean fields as affected by nodulation and nitrogenous fertilization. J. Agric. Sci., Mansoura Univ., 30 (10): 6263-6268.

تأثير التسميد علي الإصابة بالأكاروس في بعض أصناف الباذنجان وصفاتهم
أيمن كامل أبو السعد^١ و داليا محمود طنطاوي ناصف^٢
١ - معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - الجيزة - مصر
٢ - قسم الخضر - كلية الزراعة - جامعة أسيوط

أجريت هذه الدراسة بالمزرعة البحثية - كلية الزراعة - جامعة أسيوط خلال عامي ٢٠١٤ و ٢٠١٥ وذلك في العروة الصيفي المبكر، لدراسة تأثير الأسمدة الكيماوية (NPK) والأسمدة الحيوية (الفوسفورين والنيتروبيين) علي ثلاثة أصناف من الباذنجان، الأسود البلدي، الأبيض البلدي والرومي بإصابتهم بأكاروس العنكبوت الأحمر، كما تم دراسة تأثيرهم أيضاً علي صفات النمو الخضري والثمار.

وقد أظهرت النتائج أن متوسط تعداد الأكاروس علي أصناف الباذنجان الثلاثة أعلي في حالة استخدام الأسمدة الكيماوية عنه في حالة استخدام الأسمدة الحيوية، كما قد وجد أنه هناك فروق معنوية في حالة استخدام الأسمدة الحيوية علي النمو الخضري (ارتفاع النباتات - عدد الأفرع) والثمار (طول الثمرة - قطر الثمرة - وزن الثمرة) مقارنة بالأسمدة الكيماوية، علي أصناف الباذنجان الثلاثة خلال موسمي الدراسة.

ولقد أوضحت النتائج أيضاً، أن صنف الباذنجان الأبيض البلدي أكثر الأصناف إصابة بالأكاروس يليه الصنف الأسود البلدي ثم الرومي في حالة استخدام الأسمدة الكيماوية أو الحيوية خلال موسمي الدراسة ٢٠١٤ ، ٢٠١٥.

وتوصي الدراسة بأنه يجب استخدام الأسمدة الحيوية في برامج مكافحة المتكاملة وعدم المغالاة في إضافة الأسمدة الكيماوية.