Susceptibility of some Tomato (*Solanum lycopersicum*) Varieties to Red Spider Mite (*Tetranychus* SPP.) and their host plants

Louai Abdalla Mohammed Abdalla[1], Abdoalmonem Hessain Ibrahem Ahmed[1] and Ashraf Ahmed Eisa Hussein[1]

[1]Department of Crop Protection, Faculty of Agricultural Sciences, University of Gezira, wad medani- Sudan

Corresponding author email: aburetaj@yahoo.com

ABSTRACT

Red Spider mite, (*Tetranychus spp.*) is an economically important pest which causes considerable damage and threaten agricultural crops and horticultural crops. The study was carried out at wad madani at the University of Gezira experimental farm. The aim of this study is to evaluate the susceptibility of some tomato varieties (Amani, Peto 86, Castlerock and Salama) to red spider mite, also to investigate red spider mite infestation on the main vegetables crops, fields crops, trees and weeds .This method was used to determine the infestation The number of spider mite was statistically analyzed and the results showed that the highest number of spider mite infestation was recorded in Amani variety (6.20) and the lowest in Salama variety (4.05). The highest spider mite (*Tetranychus* spp.) population densities in third week (58 days) and the number of spider mites decreased steadily at the end of the season. From these results, spider mite was recorded on 11 host plants viz Eggplant, Milk weed, Gubbien, Okra, Sider, Dahasser, Higlig, Sunflower, Dura, Soy bean, Cotton. The results also showed that eggplant was highly infested (145 mites) by spider mites compared to Higlig (100 mites) The result also showed the Okra was lowest infested (9 mites) by spider mite The highly yield was recorded on Amani variety (6.295) ton/ha, but, the lowest yield was recorded in Salama variety (0.0734) ton/ha As general the Salama variety showed the lowest infested by the red spider mites (6.20), as well as, the lowest number of severity percentage was recorded on Amani (8.4).Whereas, Amani variety showed the standard number of red spider mites (4.05), as well as, the number of severity percentage. Amani variety showed

tolerance so recommended in IPM option besides removing Gubbein from Tomato grown areas.

***Keywords*:** Red spider mite, *Tetranychus* spp. Susceptibility, Tomato variety Host plant

INTRODUCTION

Tomato *Solanum lycopersicon* ranking first in the world for vegetables, accounts for 14% of world vegetable production. (FAO, 2010). It is from night –shade family: Solanaceae. Tomato attacks by many diseases and pests in Sudan. The important disease of tomato in Sudan include; Damping off- of seedling, Tomato Yellow Leaf Curl Virus (TYLCV), Powdery mildew, Bacterial spot, Late blight and Blossom end –rot. Also there are others diseases like; Alternaria leaf spot and Fuzarium wilt (Juha, 1996). The major insect pests of tomato in Sudan are; Cotton white fly, *Bemisia tabaci* (Genn) and African boll worm, *Heliocoverpa armigera* (Hb). Beside other minor pests such as; root-knot nematode, *Meloidogyne javanica* (Treub), cotton leaf worm *Spodoptera littoralis* (Boised), cotton jassid, *Empoasca lybica,* cotton soil termite *Microtermes thoracalis* (jost), tomato bug *Cyrtopeltis tenuis* (Reut), grey blister beetle *Epicauta aethiops* (Latr), and *Sarcophage destructor* (mall) (Schumtterer,1969). *Tuta absoluta* appeared in Sudan in 2010. The damage of *T. absoluta* in Sudan was reported from Khartoum, Gezira, White Nile, Kassala, River Nile State and Northern causing 60-100% of tomato crop loss. The red spider mite, and little leaf disease. (Gapud and Canapi 1994; Orden *et al.,* 1994). Spider mite (*Tetranychus* spp.) belongs to the family Tetranychidae of the order Prostigmata. The family Tetranychidae is one of the most important families of the Acarina because many species can be serious pests of agricultural crop (Faith *et al.,* 2009). spider mites (*Tetranychus* spp.) attack many cultivated crops, including maize, tobacco, cotton, beans, eggplant, pepper, tomatoes, cucurbits and many other vegetables (Mau and Kessing, 1992). Spider mite (*Tetranychus* spp.) is one of the most important pests of horticultural crops worldwide. It has been associated with up to 1,200 host plant species and has become a serious pest on many fruits, vegetables, trees, shrubs, herbs, herbaceous perennials and ornamental plants and many broad leaved weeds in field and protected settings (Khajehali *et al.,* 2009). Spider mites problem increased when natural enemies are destroyed by applications of broad spectrum insecticides, applied against

other pests (Mainul *et al*., 2010). Spider mites have been rapidly developing resistance to a series of acaricides (Croft and van de Baan, 1988) and have recently assumed a new aspect of multiple resistances (Pree *et al.,* 2002; Van Leeuwen *et al.,* 2004 and Kim *et al.,* 2006). During the last few decades, only 2 studies were carried out on the biology and ecology of the red spider mites in Sudan (El Tingari1, 994 and Abbas 1997). There are many recent records on the infestation and damage of red spider mites on many crops in different area in Sudan; however, no recent studies were recorded on this pest. Accordingly, this study was initiated to point out the infestation of this pest and its damage on some vegetables (mainly Tomato) in Gezira State.

MATERIALS AND METHODS

Study site

This study was carried out at Experimental farm, faculty of Agricultural science, University of Gezira, Gezira state Sudan.

Material and experimental lay out

The varieties seeds of Tomato were laid out in Randomized Complete Block Design (RCBD) With four replicates. Glyphosate was used as pre emergence herbicide for control the weed to establish the land for sowing tomato after applied the herbicide irrigated the land and after ten days was done by deep plowing using a chisel plow harrowed by the Disc harrow leveled and ridged for land preparation. there are four varieties of tomato (Amani, Beto 86, Castle rock and Salama) The three varieties of Tomatoes Amani, Beto86 and Castlerock obtained from the Central market/ wad Madani but, Salama variety obtained from University of Gezira faculty of Agricultural sciences. The varieties have been planted in the study site the sowing date was in February 2020. The sowing method was direct planting. Thinning was carried out two weeks after seedling emergence to two plants per hole. There are 16 experimental units and such unit contain 48 m^2. All the field Practices were followed as recommended by Agricultural Research Corporation (ARC).

Data collection

The specific surveys were carried out weekly, after 6 weeks of tomato planting. The survey was made to investigate the spider mite infestations on the main vegetable and field crops grown area. In addition of main weeds Specific survey was conducted to evaluate the status of the red spider mite infestation on to some tomato varieties four varieties of tomatoes were planted Randomly (Beto 86, Amani, Salama and Castlerock) in the study site at Gezira State the experiment was applied for seasons February 2020. The varieties were planted in terraces and the length of terraces was seven meters and its width was two meters in an area of feddan Gezira state were chosen for the study (experimental farm, University of Gezira). Carred out 4 plots, and 4 Blocks (4x4) 16 replicates. In each plot, the data collection was applied, five plants were chosen randomly along each cross line. In each plant, 10 leaves (4 upper, 2 middle, and 4 lower) were examined for red spider mite infestation. The samples were taken to the biology laboratory to confirm the mite infestation and to count the numbers under the microscope.

General survey was carried out to investigate the spider mites infestation on some alternative host plant vegetables, field crops and trees.

Statistical analysis

The collected data were subjected to analysis of variance (ANOVA) and the means were separated by the least significant difference test (LSD) for data analysis used statistic8.

RESULTS AND DISCUSIONS

Number of spider mites infestation (*Tetranychus* spp.) on different tomato varieties

There was significant difference between the mean numbers of red spider mites on different tomato varieties were shown in table1.

Table 1. Mean number of red spider mites (*Tetranychus* spp.) 50 leaves per plant on different tomato varieties Season 2020

Treatments	* Means number of mites/50 leaves					
	W1	W2	W3	W4	W5	MEANS
Amani	4.75[a]	5.25[a]	6.50[ab]	6.00[a]	8.50[a]	6.20[a]
Beto 86	4.25[a]	6.25[a]	8.00[a]	5.25[a]	5.50[b]	5.85[a]
Castlerock	4.00[a]	5.00[a]	6.25[ab]	5.75[a]	5.50[b]	5.30[a]
Salama	5.25[a]	4.50[a]	4.25[b]	5.00[a]	4.00[b]	4.05[b]

*Means of 4 replications. Means followed by same letters(s) are not significantly on difference.

The mean number of red spider mites ranged from 6.20 to 4.05. The highest number of mites (6.20) was registered on variety Amani with no significant difference between this variety with Castlerock and Beto 86. While, the lowest number of mites recorded on Salama variety (4.05).

In Table 1 There was no significant difference in the first and second count in the term of number of mites (44 days and 51 days after planting) but the high number of mites recorded on Salama variety (5.25) in the first count and Beto 86 on second count (6.25) respectively. whereas, the lowest number of mites recorded on second week (5.00) and (4.50).

The third week (58 days after planting) showed significant difference between the varieties. The highest number of red spider mites recorded on Beto 86 (8.00) and the lowest on Salama variety (4.25) while, the Salama variety showed the lowest number of mites which statistically on par with Castlerock and Amani varieties.

in the fourth week (65 days after planting) again the plant showed no significant difference (in case of high levels of humidity as the result of irrigation) but still Salama obtained the lowest number of mites.

in the fifth week (72 days after planting) the number of mites ranged between (4.00 to 8.50) which Salama variety recorded the lowest number of mites (4.00) and which statistically on par with Beto86 and Castlerock. And Amani showed the highest number of mites (8.50).

The results revealed that the beak of number of red spider mites on the third week of count (58 days after planting), which consider as optimum for control red spider mite that agree with (Sithanantham *et al*. (2001) finding.

Infestation percentage of tomato varieties by red Spider mites (*Tetranychus* spp.) In the study site

There is no significant difference on the term of severity on tested tomato varieties infested by mites on the first, second and third count. while, in the fourth count (65 days after planting) there are statistically different among the varieties. whereas the severity ranged between (6.5 to 10.5) The varieties Salama showed the lowest severity percentage which is statistically on par with Castle rock and Beto 86 while the Amani showed the highest percentage of severity (Table 2).

As general the Salama variety showed the lowest number of red spider mites as well as lowest infestation on mites. Whereas, Amani variety showed the standard number of red spider mites as well as the severity percentage of red spider mites.

The peaks of percentage of severity on the third week (58 days after planting) which is confirmed the highest number red spider mites on this period and the focusing the mites control or before this period.

Yield tested of tomato varieties

The data of tomato yield was presented in Table 3. Statistically there was significant difference between the tested tomato varieties on yield which it was ranged from (0.0734-6.295 ton/ ha). The Record Amani variety was obtained the highest fruit yield (6.295) ton/ ha. On the other hand, the lowest fruit yield was recorded in Salama variety (0.0734 ton/ ha). The results showed that. the variety Amani gave the highest fruit yield inspite of the highest mean number of red spider mites and highest percentage of severity among

Table 2. Infestation of tomato varieties by Spider mites (*Tetranychus* spp.), In the study site

Varieties	%Severity Infestation
Amani	8.4[a]
PETO 86	8.4[a]
Castlerock	7.5[ab]
Salama	7[b]
SE±	0.33
C.V%	8.36

* Means flowed by same letters (s) are not significantly difference

the tested varieties and this variety considered as tolerant variety, which is favorable for IPM program.

Table 3. Yield of tomato varieties infested by red spider mites

Treatment	Yield /ton/ha
Amani	6.295[a]
Peto 86	1.0405[b]
Castlerock	1.0995[b]
Salama	0.0734[c]
SE+	9.80
CV%	0.12

The general survey showed that, the vegetable crops and field crops in the study site were infested by spider mites, with variable degrees of infestation. The eggplant showed high number of red spider mites (145 mite). The lowest number of red spider mites was noted in Okra, *Abelmoschus esculentus* (9 mites) In addition, three weeds from different

families showed various degrees of infestation by spider mites during the survey period. The highest number of red spider mites (96 mites) of weeds was recorded on weed Gubbien, *Solanum dobium* and the lowest infestation was noted in Milk weed**,** *Euphorbia hirta* (25 mites). The survey also, include the trees on the study site, Higlig, *Balanites aegyptica* showed highest number of red spider mites (100 mites). the lowest number of red spider mite was noted on Sider (*Ziziphus spina-chirsti*) (42 mites) (Table 6).

Table 4. Number of red spider mites (*Tetranychus* spp.) on some weeds

Weeds	*Means no of mites per/ 10 weeds
Gubbien, *Solanum dobium*	96
Dahaseer, *Indigofera oblengifolia*	79
Milk weed, *Euphorbia hirta*	25
Total	200
Means	183.3

Table 5. Number of red spider mites on some trees

Trees	Means no of mites per/ ten trees
Sider, *Ziziphus spina-chirsti*	42
Higlig, *Balanites aegyptica*	100
Total	142
Means	71

CONCLUSION AND RECOMMENDATIONS

All the tomato varieties grown at the study site were infested by red spider mite. Salama variety showed the lowest means number of red spider mites**.**

Spider mite, *Tetranychus* spp. populations increased slowly at the beginning of season (week 1) and then rapidly reach the maximum density at week 3 and the number of spider

mites decreased steadily at the end of the season. The highest number of red spider mites (6.20) was recorded on variety Amani with no significant difference with Castlerock and

Table 6. Mean number of red spider mites on some crops

Crops	*No of mites per /10 plants
Cotton, *Gossypium* spp.	33
Okra, *Abelmoschus esculentus*	9
Soy bean, *Glycine max*	32
Sun flower, *Helianthus annuus*	28
Dura, *Sorghum bicolor*	16
Eggplant, *Solanum melongena*	145
Total	263
Means	43.8

Peto 86. Salama variety showed the lowest number of red spider of mites as well as the lowest mean number of infestation. Amani variety was showed the highest fruit yield (6.295) ton/ ha. on the others hand, the lowest fruit yield was recorded on Salama variety (0.0734) ton/ ha.

Spider mites infestation on some crops was high especially on Eggplant, *Solanum melongena* and Gubbien, *Solanum dobium* and should be considerable for control alternative host plant.

REFERENCES

Abbas, M. M. A. (1997). Some Biological and Ecological Aspects of the Two- Spotted Spider Mite *Tetranychus urticae* Koch (Acarina: Tetranychidae) on Snap bean and Its chemical control. M.Sc. Thesis, Faculty of Agriculture, University of Khartoum, Sudan.

Croft, B. A. and van de Baan, H. E. (1988). Ecological and genetic factors influencing evolution of pesticide resistance in tetranychid and phytoseiidmites. *ExpApplAcarol*, 4: 277–300.

El Tingari, O. I. A. (1994). Some Biological and Ecological Aspects of the Two-Spotted Spider Mite Tetranychusurticae Koch (Acarina: Tetranychidae) on Groundnut and Its chemical control. M.Sc. Thesis, Faculty of Agriculture, University of Khartoum, Sudan.

Faith, J. T., Edward, A., Uecker, M., Pieter, D. T. and Markus, K. (2009). The Tetranychid mite (Acarina: Tetranychidae) of Kenya and a 47 redescription of the species Peltanobiaerosmusi, Meyer (Acarina: Tetranychidae) based on males. Zootaxa, 2176: 33-47.

FAO, (2010). Plant genetic resource for food and agriculture. Rome, Food and Agriculture Organization of the United Nation.

FAOSTAT, (2017). Production – Crops – Area harvested/ Production quantity – Tomatoes – 2014, FAO Statistics online database, Food and Agriculture Organization, Rome, www.fao.org/faostat/en (accessed 22 Sept. 2017).

Gapud, V. P. and Canapi, B. L. (1994). Preliminary survey of insects of onions, eggplant and string beans in San Jose, Nueva Ecija. Philippines Country Report, IPM CRSP First Annual Report

Juha, H. O. (1996). Introduction in plants pathology. University of Gezira. DarElasalam For Press, Publish and Media products. pp157,

Khajehali, J. T., Van Leeuwen, L. and Tirry, M. (2009). Susceptibility of an organophosphate resistant strain of the two-spotted spider mite

(Tetranychusurticae) to mixtures of bifenazate with organophosphate and carbamate insecticides. *Experimental and Applied Acarology*, 49: 185-192.

Kim, Y., Park, H., Cho, J. and Ahn, Y. (2006). Multiple resistance and biochemical mechanisms of pyridaben resistance in Tetranychusurticae (Acarina: Tetranychidae). *J. Econ. Entomol.,* 99: 954 – 958.

Mainul, H. M., Ali, A. and Mursalin, P. (2010). Voracity of three predators on two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) and their developmental stages Research *Journal of Agriculture and Biological Sciences*, 6(1): 77-83.

Mau, R. F. and Kessing, M. (1992). *Tetranychus cinnabarinus* (Boisduval) Department of Entomology Leaflet, Honolulu, Hawaii.

Orden, M. E. M. Patricio, M. G. and Canoy, V. V. (1994). Extent of pesticide use in vegetable production in Nueva Ecija: Empirical evidence and policy implications. Research and Development Highlights 1994, Central Luzon State University, Republic of the Philippines, p. 196-213.

Pree, D. J., Bittner, L. A. and Whitty, K. J. (2002). Characterization of resistance to clofentezine in populations of European red mite from orchards in Ontario. *Exp Appl Acarol*., 27:181–193.

Schmutterer, H. (1969). Pests of crops in North East and Central Africa-with particular reference to the Sudan. Gustav Fisher Verlag Stuttgart Port Land, USA.

Sithanantham, S., Abera, T. H., Baumga¨rtner, J., Hassan, S. A., Lo¨hr, B., Monje, J. C., Overholt, W. A., Paul, A. V. N., Hao Wan, F. and Zebitz.

C. P. W. (2001). Egg parasitoids for augmentive biological control of lepidopteran vegetable pests in Africa: research status and needs. *Insect Sci Appl* 21:189–205

Van Leeuwen, T., Stillatus, V. and Tirry, L. (2004). Genetic analysis and cross- resistance spectrum of a laboratory selected chlorfenapyr resistant strain of two-spotted spider mite (Acarina: Tetranychidae). *Exp Appl Acarol*, 32:249–261.

الملخص

يعتبر الحلم العنكبوتي الأحمر (*Tetranychuss* pp.) آفة ذات أهمية اقتصادية تسبب أضرارًا كبيرة وتهدد المحاصيل الزراعية ومحاصيل البستنة. يؤدي تغذي الحلم العنكبوتي الأحمر إلى تقليل حجم وجودة المحصول. أُجريت الدراسة بود مدني بالمزرعة التجريبية لجامعة الجزيرة. كان الهدف من هذه الدراسة هو تقييم قابلية بعض أصناف الطماطم (أماني، بيتو 86، كاسل روك وسلامة) للإصابة بالحلم العنكبوتي الأحمر، وكذلك تقصي انتشار الحلم العنكبوتي الأحمر في محاصيل الخضروات الرئيسية، والمحاصيل الحقلية، والأشجار، والأعشاب الضارة. أُستخدمت هذه الطريقة لتحديد شدة الإصابة. تم تحليل عدد العناكب إحصائيًا. أظهرت النتائج أن أعلى عدد للإصابة بالحلم العنكبوتي الأحمر سُجل في الصنف أماني (6.20)، وأدناها في الصنف سلامة (4.05). سُجلت أعلى كثافة الحلم العنكبوتي الأحمر (*Tetranychus* spp.) في الأسبوع الثالث (58 يومًا)، وتناقص عدد الحلم بشكل مطرد في نهاية الموسم. أظهرت هذه النتائج أن العنكبوتي الأحمر سُجل في 11 نباتًا مضيفًا وهي: (الباذنجان، أم اللبن، الجبين، البامية، السدر، الدهاسير، الهجليج، عباد الشمس، الذرة، فول الصويا والقطن). كما أظهرت النتائج أن الباذنجان كان الأعلى إصابة بالعنكبوت الأحمر (145 عنكبوت /10 اشجار) مقارنة اشجار الهجليج (100عنكبوت /10 اشجار). وأظهرت النتائج أيضًا أن البامية كانت الأقل إصابة (9) بالحلم العنكبوتي الأحمر. سُجلت أعلى انتاجية في الصنف أماني (6.295 طن/هكتار)، في حين سُجلت أدنى انتاجية في الصنف سلامة (0.0734 طن/هكتار). بشكل عام، أظهر الصنف سلامة أدنى إصابة بالحلم العنكبوتي الأحمر (6.20)، بالإضافة إلى تسجيل أدنى نسبة لشدة الإصابة على الصنف أماني (8.4). بينما أظهر الصنف أماني العدد القياسي للحلم العنكبوتي الأحمر (4.05)، وكذلك نسبة شدة الإصابة. أظهر الصنف أماني تحملاً، لذا يوصى به في خيارات الإدارة المتكاملة للآفات (IPM) بالإضافة إلى إزالة نبات الجبين من مناطق زراعة الطماطم.