Population dynamicsof*Tetranychusurticae*Koch.and associated predators in relation to certain ecological factors in sweet potatofields

ABSTRACT

The two spotted spider mite, *Tetranychusurticae* is a highly polyphagous sap sucking pest, without a hibernation period,efficacy all the year round. He is destructive pest of important and fieldsand vegetable crops. This investigation was carried out atBeheira Governorate during 2023 and 2024 seasons, to monitor the population fluctuations of the spider mite and their predators; *Stethorusgilvifrons*Mulsant,*Coccinellaundecimpunctata* L., *Chrysoperlacarnea*Stephand*Scymnusinteruptus*Goeze. In the first season, the infestation of*T. urticae* started on sweet potato plants at low numbers, the population increased gradually to reach its highest peak during 22th July (19.75*Sc. interuptus*individ.). This peak was followed by a relatively high population of the four predators, *S. gilvifrons*(4.75), *C. undecimpunctata* (5.00individ.), *Ch. carnea*(8.00 individ.)and*Sc. interuptus.* (5.00individ.). The second peak of the mite was detected on 14st Aug. (48.00individ.), synchronized with the peaks of the four predators. During 2022, the first incidence of the mite was recorded on 22th July. (44.25individ). This peak was associated with the peak of the four predators. The second peak of *T. urticae* was observed on 14th Aug.(25.75 individ.), it coincided with the peaks of the four predators. The infestation of*T. urticae* and their predators were highly significantly correlated with weather factors (Max., Min°c and RH). From the found data in this experiment,advise that together predators could be effectively application as biological control agents for*T. urticae* management.

Key words: *Tetranychusurticae*, weather factors, predators

INTRODUCTION

Sweet potato, *Ipomoeabatatas* L. crop is one of the feed crops in the around world for man and animal (FAO 2015). The two spotted spider mite,*Tetranychusurticae* Koch (Acari: Tetranychidae) is one of the most important pest causing severe economic reduce to the produces, feeding on the mostspecies of plants (Jakubowska and Fiedler 2014). Also, Gaber *et al*., (2023) indicated that is considered one important pest that causeddamage on the more crops and decrease in quality and quantity of the product thus was one peak

Aug.7th. On the other hand, Mulukenet *al.,* (2016) mentioned that the moving stages of the spider mite feed mostly on sweet potato plants. Bocianowskiet *al*., (2022) showed that the spider mite, *T. urticae* impact on both theupper and lowerside of the leaves in shining places. Nagrare 2012)Sweet potato *Ipomoeabatatas* L crop is one of the food crops in the Egyptian economy for man and animal. In general, through the two seasons, infestations of sweet potato plants, during the growth crop stage, cause severe economic reduced to the crop. Ibrahim (2018) found that five larvae of *Ch. carnea*/ 100 individual of the mealy bug can be applied as a biological control with *P. solenopsis*. Farhan *et al*., (2011) found that the lacewing, *Ch. carnea* was more efficient as biological control against cotton mealybug, *P. solenopsis*. The information generated may be used for designing a comprehensive pest management program and prediction models for the spider mite,*T. urticae*. The present study was planned to infestation the population density of the two spotted spider miteon sweet potato plants as affected by predators and to determine its, activity to certain synthetic predators under field conditions.Errardet *al.*,(2016) mentioned that the green lacewing, *Ch.carnae* could therefore contribute to the decreased of the spider mite infestation on the plants.Farazmandet *al.,* (2014) showed that the adult and larval stages of *S. longlcorms* play on important role in decreased mite populations. El-khouly and Farag (2022) found that the coccinellid predator, *S. gilvifrons* is one of the most important natural enemies of *T. urticae*. El-Basha, (2015) found that the adult of the intraguila predation (IG) predator, *S. gilvifrons* consumed more nymphs of IG mite species. The role of the predator,*S. gilvifrons*reduced population of *T. urticae* on cantaloupe plants at Ismailia Governorate (.Ahmed *et al*2006). The predator, *S. gilvifrons*(adult and larvae) play an important role in reduction mite populations and was associated with this mite on caster been and tomato.(EI Adawy *et al*., 2000, Abdel Gayed,2004 and Abou EI-EIa.2014). The establish data in this work advise that both,*S.gilvifrons,C.undecimpunctata*, *Ch. carnea*and*Sc. interuptus* could be activity application as biological control agents with spider mite management.

MATERIALS AND METHODS

1-Land preparation and sowing

This experiment was conducted carried out at Edfina Rasheed region, Beheira Governorate during 2023 and 2024 summer seasons, in an area 2100 m^2, divided into four equal parts. The land was prepared by laughing three times with calcium superphosphate at the rate of 250 kg /fed. Sweet potato (*Ipomoeabatatas* L.) seedlings were Trans in the presence of water at the upper third of the furrows at the beginning of May in both years of study. Sulpha potassium (100 kg/fed.) and nitrogen fertilizer were app as recommended.

2-Sampling for counting the predators

One month after sweet potato Trans planting, 25 plants were pulled out from each plot. The plants were gently confined in plastic bags and transferred to the laboratory of counting the three considered predators,*S. gilvifrons, C. undecimpunctata* L., *Ch. carnea*Stephand*Sc. interuptus.*.This sampling technique was followed for four examine times, as the plants were still young with small size. After that, the sample was one branch of potato plants that was cat gently and confined in plastic bags, as 25 branches were taken from each replicate do visually count the numbers of the three abovementioned predators. The sampling began on June 1st up to June 5th.

3-Sampling for counting spider mite

Spider mite, *T. urticae* Koch (Agari: Tetranychidae) were counted on 25 leaflets per replicated. The leaflets were weekly picked up and transferred to the laboratory for counting both arthropods, using binocular microscope.

Statistical analysis

Data of the present experiment indicated that the correlation coefficients for the relationship between the two spotted spider mite and their predators in sweet potato fields, results obtained were statistical analyzed using Duncan's Multipole test (Duncan. 1955).

RESULTS AND DISCUSSION

1. Population fluctuations of*T.urticae*

Results shown in Tables (1 and 2)indicated that the two spotted spider mite, *T. urticae* was observed in low population densities up to June 15nd, and exhibited the first peak with 19.75 nymphs and adults/25 leaflets on Jule22th. Twospider mite peaks; 48.00 and 21.50 individual /25 sweet potato leaflets were showed on July 14th and July 21th, respectively in

2023. In 2024 season,the two spotted spider mite, *T. urticae* population densities were observed in two peaks of occurrence; 44.25 and 25.75 individual/ 25 sweet potato leaflets on Jule 22thand Aug 14th, respectively.Overall means of the two seasons were very similar (13.64) and 13.25) individuals, 25 leaflets in the first and second seasons, respectively.

2-Population fluctuations of the predators

Results of tables (1 and 2) mentioned that the numbers of *S. gilvifrons* appeared in June 30th(1.25 individual) and increased gradually to reached its peak in July 22th, represented by 19.75 individual, indicating a second peak during Aug. 14th, represented by 5.00 individual during the first season. While, in the second season it appeared in late June and reached the first peak at the end July (4.75 individual) and the second peak in mid-Aug., represented by 4.25 individual.Data of tables (1 and 2) indicated that thepopulation fluctuation of the ladybird was very decrease up to June, and relatively increased by late June. Then, *C. undeciompunctata* population fluctuation to exhibit low densities of 4.75 and 5.75predatory individuals by per 25 potato branches, in the first and second seasons, respectively.Almost the same trend was detected, but with relatively high two peaks on July 22th and Aug.14th, with 5.00 and 10.00 predatory individuals, respectively, in 2021, 9.50 and 5.75individuals, in the second season, respectively.Generally, in a comparison, *C. undeciompunctata* individuals were relatively in the second season than in the first one. Results of Table (1) showed that the chrysopid, *Ch. carnea* appeared in sweet potato field in June 15th and increased gradually reached to highesttwo peakswith 8.00 and 11.75 larvae / 25 potato branches were detected on July 22th and Aug. 14st, respectively in 2023. While, in the second season, found the two peaks with 9.50 and 7.50 larvae / 25 branches on July 22th and Aug.14th, respectively (Table 2). Overall means in both seasons were similar. As shown in Tables (1 and 2) data obviously indicated that theoverall mean of*Sc. Interuptus*in 2024season was obviously higher (3.93 individual/ 25 branches) than that of 2023season (3.71individual). In the first season, the predator was observed with considerable highlynumbersby July 22thand Aug. 14st, represented by 5.00 and 9.75individual, respectively.However, in the second season, the insect densities were relatively high by late- June (3.50 individual), mid- Aug. (6.00 individual) and early September (6.25 individual).

3. Relationship between the some weather factors, numbers of *T. urticae* and their predators by correlation coefficients

Results presented in Table (3) indicated that the estimates of correlation coefficients among the some weather factors, populations of the two spotted spider mite and their predators in 2023 and 2024 seasons are recorded. Therefore, the relationship between weather factors, mite and predators, showed positive and high significant. the maximum temperature correlated with negative values, in most cases, with numbers of *T. urticae* and their predators. However, the relative humidity and minimum temperatures were generally positive and highly significant values with the considered mite and their predators in the first and second seasons.

Table 1:Population fluctuation of *T. urticae*and associated predators on sweet potatobranches, at Edfina- Rashed region in season 2023

Date of examination	No. of *Tetranychusurticae* / 25 leaflets	No. of predators / 25 plant			
		Stethorusgilvifrons	*Coccinellaundecimpunctata*	*Chrysoperlacarnea*	*Sc. interuptus*
June 1	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00
15	5.75	0.00	1.50	2.50	1.75
22	9.50	0.50	2.75	4.25	3.25
30	13.50	1.25	4.75	5.00	3.75
No. /25 leaf		No./25 branches			
July7	15.25	2.75	3.00	1.50	2.00
15	16.00	2.75	4.25	3.00	3.75
22	19.75	4.75	5.00	8.00	5.00
30	8.50	4.50	3.75	3.00	4.75
Aug.7	9.25	4.25	6.75	8.75	6.00
14	48.00	5.00	10.00	11.75	9.75
21	21.50	2.25	6.00	8.75	5.00
8	8.25	2.75	4.00	4.25	4.00
Sept. 5	15.75	0.05	5.75	5.00	3.00
Overall+SE	13.64+1.78	2.34+1.01	4.10+1.41	4.69+1.50	3.71+1.08

Table 2: Population fluctuation of*T. urticae*and associated predators on sweet potato plants, at Edfina- Rashed region in season 2024

Date of examination	No. of *Tetranychusurticae* / 25 leaflets	No. of predators / 25 plant			
		Stethorusgilvifrons	*Coccinellaundecimpunctata*	*Chrysoperlacarnea*	*Sc. interuptus*
June 1	0.00	0.00	1.00	1.05	1.25
8	4.25	0.00	2.00	1.75	1.75
15	4.75	0.00	2.50	3.75	2.75
22	7.25	1.05	5.50	4.00	3.50
30	6.75	2.25	5.75	4.75	2.05
No. / 25 leaf		No. /25 branch			
July7	11.50	3.25	4.75	4.00	1.75
15	16.50	3.75	7.25	3.50	6.75
22	44.25	4.75	9.50	9.50	8.00
30	14.75	4.25	4.25	5.25	2.75
Aug.7	10.75	4.05	2.75	7.00	3.00
14	25.75	4.25	5.75	7.50	6.00
21	12.75	2.75	4.00	4.75	5.25
8	9.75	2.00	2.50	3.75	4.00
Sept. 5	16.50	1.75	4.00	5.75	6.25
Overall+SE	13.25±1.45	2.43±0.98	4.36±0.01	4.73±0.21	3.93±0.01

Table (3). Correlation coefficients between some weather factors and main pests and their predators on sweet potato plants during 2023 and 2024 seasons.

Factor	*Tetranychusurticae*	*Stethorusgilvifrons*	*Coccinellaundecim-punctata*	*Chrysoperlacarnea*	*Sc. interuptus*
2021					
Max.Tem(°c)	0.788**	+0.754**	+0.567**	-0.244	-0.198
Min. Tem (°c)	+0.327*	+0.653**	+0.276	+0.567**	+0.408*

RH%	+0.201	+0.644**	+0.745**	+0.664**	+0.453*
2022					
Max. Tem(°c)	-0.288	0.234	+0.356	+0.313	-0.209
Min. Tem (°c)	+0.633**	+0.744**	+0.579**	+0.546**	+0.323
RH%	+0.543**	+0.587**	+0.654**	+0.698**	+0.388*

*significant, $P \leq 0.05$ -** highly significant, $P \leq 0.01$

These results are in agreement with those obtained by Mulukene*t al* 2016 indicated that the adults and immature stages of *T. urticae*, feeding on sweet potato, result in high levels of plant destruction damage of 103 million bales, resulting in very large economic damage. Ramzan *et al.,* (2019) observed that both *Chrysoperlasp*and coccinellids spp were active, in cotton fields in June and September, respectively.El- Shamy *et al.,* (2023) observed that significantly correlation between populations of spider mite by onion intercropping with tomato and each of maximum and minimum temperature. Contracting to our results, they also found significant correlations between both predators and*T. urticae*. El-Khouly and Farag (2022) found that integrated pest management is the best way to control *T. urticae*and they added that biological control. Farag *et al*., (2023) concluded that *T. urticae* caused significant economic losses of the agricultural crops. Taghizadeh *et al.,* (2008) mentioned that the studied growth of *S. gilvfrons*, a predator of *T. urticae* under laboratory conditions at constant temperatures of 15, 20, 25, 28, 30, 35 and 40°C. No growth occurred at 40°C. The total growth time at temperatures established was 65.47, 31.19, 18.53, 17.54, 12.49 and 9.27 days, correspondingly.

REFERENCES

Abo El-Ella, A. A. (2014). Efficacy of five acaricides against the two spotted spider mite, *Tetranychusurticae* Koch and their side effects on some natural enemies, J. of basic & Applied Zoology, 67,13-18.

Abdel Gayed, A. A. (2004). Studies on effect of some pesticide residues on some pests attacking tomato and associated predators, Ph. D. Thesis Fayoum Fac. of Agric., Cairo Univ. pp. 141.

Ahmed, S. A.; A. M. El-Adawy; Y. M. Ahmed; A. A. El-Sebae and M. M. Ibrahim (2006). Release of the coccinelld Predator, *Stethorusgilvifrons* (Mulsant) and Bio-rational Pesticides to suppress the Population of *Tetranychusurticae* Koch on Cantaloupe Plants in Egypt. Egyption Journal of Biological Pest Control, 16(1):19-24.

Bocianowski, J.;M. Jakubowska; D. Zawada and R. Dobosz (20022). The Effect of Acaricide Control of the Rwo- Spotted Spider Mite *Tetranychusurticae* Koch on the Cultivation of Sugar Beet (Beta vulgaris L.) and on the Size and Quality of the Yield. Journal of Applited Sciences, 10(2): 102-107.

Duncan, D. B. (1955). Multiple ranges and multiple F. testy. Biometrics, 11: 1-42.

El-Adawy, A. M.; H. Yousri; Y. M. Ahmed; K. Tiilikkala and T. A. El-Sharkawy (2000). Estimation of general selective toxcicty ration of certain acaricides to *Stethorusgilvifrons*Mulsant and its prey *Tetranychusurticae* Koch Egypt J. Agric. Res., 78(3):1081-1089.

El-Basha, A. Nesrin (2015). Intraguild Prewdation And Cannibalism Among Mite Predators: *Stethorusgilvifrons* (Mulsant) (Coleoptera: Coccinellae), *Oriusalbidipennis* (Reuter) (Hemiptera: Anthocoridae) And *Scolothrips longicornis* Priesner (Thysanoptera: Rhripidae). Egypt. Acad. J. Biolog. Sci., 8(3): 1-11.

EL- Khouly, N.M. and Marw M.A. Farag (2022). Effect of some acaricides on the biology of *Stethorusgilvifrons*Mulsant (Coleoptera: Coccinellidae) as predator of *Tetranychusurticae*Koch. Fayoum Journal of Agric. Res. And Deveel. 36 (3): 379-386.

El-Shamy, A. Moshira.; A.A. Farag; H.A. Abd El- Rahman; E. A. El-Shamy and M. A. A. Abdallah (2023).Efficacy of plant oils and insecticide for controlling *T. urticae*Kooh as influenced by Onion Intercropping with Tomato Middle East J.Appl. Sci.,13 (1): 26 - 37.

Errard, A.; C. Urichs; S. Kuhne; I. Mewis; N. Mishig; R. Maul; M. Drungowski; P. Parolin; M. Schreiner and S. Baldermann (2016). Metabolite Profiling Reveals a Specific Response in Tomato to Predaceous *Chrysoperlacarnea* Larvae and Herbivore(s)-Predator Interactions with the Generalist Pests *Tetranychsurticae* and *Myzuspersicae*,Vol. 7 Artic.1256.

Farag, A. A.; E.A.El-Shamy andH.A. AbdEl-Rahman (2023).FieldStabilityofSomeCompoundsAgainst*TetranychusUrticae*Kochand*Pectinophoraa Gossypiella*(Saunders)on CottonPlants. JournaloftheAdvancesinAgriculturalResearches(JAAR).28(1):166-176.

FAO, (2015). Food and Agriculture Organization of the United Nations (FAO), Food and Agriculture Organization Statistical Databases (FAOSTAT), 2015.

Farazmand, A. Fathipour, Y. and K.Kamal (2014). Cannibalism in *Scolothripps longicornis* (Thysanoptera: Thripidae), *Neoseiulus californicus* and *Typhlodromusbagdasarjani* (Acari: Phytoseiidae) Systematic & Applied Acarology, 19(4):471- 480.

Farhan, A.; W. Akram; A. Sajjad and A. U. Iran (2011). Management practice against cotton mealybug, *Phenacoccussolenopsis* Tinsley (Hemiptera :Pseudococcidae). Int. J. Agriculture and Biology, 13(4):547-552.

Gaber, W. M.; N. F. Abou-elenien and E. A. Shehata (2023). Population fluctuation of *Tetranychusurticae* on sweet potato (*Ipomoca batatas* L.) and effect of some insecticides. Egypt Acad. J. Biology. Sci., 15(1):123-127.

Ibrahim, S. S. (2018). Study on cotton host plants of mealybug, *Phenacoccussolenopsis* (Tinsley) and efficiency of its controlling on cotton plants in Egypt release the predators *Chrysoperlacarnea* (Stephens). J. Plant. and Path., Mansoura Univ., 9(3): 247-252.

Jakubowska, M.; Z. Fiedler, Plantacjeburak ow zagrozoneprzezprz, e3dziorki. Wa (2014), zny jest monitoring [Beet plantations endangered by mites]. Poradnik, PlantaotoraBurakaCukrowego, 2, 53-54.

Muluken, G.; M. Dejene; A. Kassaye and T. Belay (2016). Red spider mite,*Tetranychusurticae* Koch (Arachnida: Acari: Tetranychadae): A threatening pest to potato (*SolanumTuberosum* L.) production in eastern Ethiopia. Pest Management J. of Ethiopia, 19:53-59.

Nagrare, V. S.; R. Kumar; M. Amutha; B. Dharajothi; B. Kranthi; S. Vennila; A. J. Deshnukhg; K. D. Bisane and K. R. Kranthi (2012). A record of host plants of mealybug, *Phenacoccussolenopsis* Tinsley for devising ecofriendly management strategies. J. Ent. Res., 36(4): 327-344.

Ramzan, M.; U. N. Ullah; M. Ishiaq; G. Murtaza; M. A. Qayyum and F. Manzoor (2019). Population dynamic of natural enemies and their correlation with weather parameters in cotton. J. of Innovative Sci., 5(1): 40- 45.

Taghizadeh, R.; Y. Fathipourand K. Kamali (2008). Temperature-dependent development of Acarophagousladybird,*Stethorusgilvifrons*Mulsant (Coeoptera: Coccinellidae). J. of Asia-Pacific Entomol. 11 (3): 145-148.