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Dynamics of two spotted red spider mite *Tetranychus urticae* Koch (Acari: Tetranychidae) in grape vineyards and its co-relation with abiotic factors and a predator

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Abstract
Two spotted red spider mite *Tetranychus urticae* Koch is emerging as key pest of grapes grown in Karnataka recently. Population dynamics studies were under taken in two fixed plots of Vijayapura district *viz.*, Jumnal (Tq: Vijayapura) and Atharga (Tq: Indi) through surveillance to know the status of this new pest. The mite incidence commenced at Jumnal and Atharga from 47th and 45th standard week of November 2012 and continued up to 15th and 17th standard week of April 2013 respectively. The seasonal mean incidence of mites was 13.7 and 14.6 per square inch of leaf in these two villages respectively with higher incidence between January to April months. The correlation studies on population of *T. urticae* was significantly and positively correlated with maximum and minimum temperature, whereas negatively correlated with relative humidity and non-significant with rainfall.

Keywords: Population dynamics, grape, *Tetranychus urticae. Weather. Euseius*

1. Introduction
Grape (*Vitisvinifera* L.) is one of the commercially important fruit crops of the world and is fairly good source of minerals like calcium, phosphorous, iron and vitamins like B_1 and B_2. Its juice is mild laxative and acts as stimulant for kidneys. Fruits are used for table purpose, wine preparation, juice, resins and canning. Fresh and dried fruits have various uses in ayurvedic and unani medicine. The primary centre of origin for grape is supposed to be Armenia near the Black and Caspian seas in Russia, and is widely grown in temperate zone. However it has acclimatized to sub-tropical and tropical agro climatic conditions prevailing as in the Indian sub-continent. It is extensively grown in France, Italy, America, Africa, Australia, Algeria and India. In the year 2010-11, major grape growing states in India were Maharashtra (62.7%), Karnataka (26.8%), Andhra Pradesh (2.2%), Mizoram (1.7%) and Tamil Nadu (4.3%), others (2.4%) amounting to nearly 90 per cent of the total production [1]. India is the 13th largest producer of grapes appropriating 2.00 per cent of the global production. The area under grapes in India was 1.17 lakh hectares during 2013 with the production of 24.83 lakh tones of fresh grapes with an average productivity of 21.1 t / ha. In India, Karnataka occupies second position in cultivation and production of grapes next to Maharashtra. In 2010-11, Karnataka contributed to about 14.3 per cent of the total Indian grape area (18,100ha) with production of 3.30 lakhtons with productivity of 18.3 t/ha [1]. In Karnataka major grape growing districts are Bangalore, Chikkaballapur, Kolar, Vijayapura, Belgaum, Koppal, Bagalkot and Gulbarga. In 2010-11, Vijayapura district contributed an area of 6,137 ha, production of 97,592 tons, with average productivity 15 t/ha. Large acreages of grape cultivation is quite evident in Basavana Bagewadi, Vijayapura, Indi, Muddebihal and Sindagi Taluk of Vijayapur.
Commercial cultivation of grapes tends to attract various kinds of pests to the vineyards. As many as 132 insects have been known to attack grape vine in the world wide [2]. In India as many as 60 species of insects and a few mites have been found damaging vines [11]. However, acarine pests have been considered to be most dreaded very recently in Indian scenario. Six species of mites viz., *Tetranychus urticae* Koch, *T. cinnabarinus* Boisdual, *T. neocaledonicus* Andre, *Oligonicus mangiferus* Rahmen and Sapra, *O. punicae* Baker and *Eutetranychus orientalis* Klein are found causing damage to grapevine in India. Out of these the infestation of *Tetarnychus urticae* is reported to be quite considerable in abundance and damage designating it as an emerging sucking pests of grape these days [3]. It has been confirmed recently that *Tetranychus urticae* relish the grapes in terms of their bionomics supporting continued

Pestiferousness [9]. Now, it is known to cause severe yield loss both qualitatively and quantitatively through direct effects like loss of chlorophyll, stunting of growth, stippling, webbing, leaf yellowing, defoliation, leaf burning, reduction in size and quality of fruits and appearance of various types of plant deformities. A recent estimation revealed 16.93 to 47.20 % avoidable yield loss due to mite infestation with best possible management options [10]. However, the information with respect dynamics of mites in grapes is limited. In the present investigation the in-season variation in the mite populations have been studied to know status in grape orchards. Further the co-relation of mite incidence with environmental factors also has been elucidated to understand the factors responsible for buildup of pest. This will help in knowing the when and why the pest would be serious in grapes.

2. Materials and methods

Population dynamics studies were undertaken during 2012-13 in two fixed plots of Vijayapura district *viz.*, Jumnal (Tq: Vijayapura) and Atharga (Tq: Indi) for surveillance. Jumnal is located between 16º 44' 25"N latitude and75 º 43' 18.15"E longitude at an altitude of 606 meters above mean above sea level whereas Atharga is located between 16°58'60' N latitude and 75º54'00'E longitude at an altitude of 483 meters above mean above sea level. Observations were made in selected farmer's grapevine garden at weekly intervals throughout the season.

For observation five vines were selected and tagged in each location. Every plant served as a replication. Three canes/vine and five leaves/cane were selected covering top, middle and bottom canopy for observation with respect to mites. The leaves were collected separately in polythene bags and brought to the laboratory for observation under stereo-binocular microscope. The numbers of phytophagous mites (nymphs and adults) were counted on per square inch area basis in each leaf. The predatory mites were recorded per leaf basis from the sampled leaves. The plants selected for this study at both sites were kept unsprayed for insect pests / mite incidence. The garden was six year old at Jumnal and nine years old at Atharga respectively both with CV Thomson Seedless maintained with standard crop husbandry. Due care was taken to keep these experimental gardens devoid of acaricide spray.

Data on seasonal incidence of mites (pestiferous and predatory) in grape at fixed plots has been presented as mean data on standard week basis. Further the data of phytophagous mites was correlated with weather parameters *viz*., maximum and minimum temperature, morning and evening relative humidity and rainfall. The meteorological data was obtained from Regional Agricultural Research Station, Vijayapura and nearby Government observatory. For simple correlation and multiple regression analysis SPSS programme version 8.0 was used.

3. Results and discussion

3.1 Population dynamics of *T. urticae* and predatory mites in grape

The seasonal dynamics of pestiferous mite *T. urticae* in grape and its predatory mite *Euseius* sp. in two geographically isolated locations *viz.,* Jumnal and Atharga of Vijayapura district during 2012-13 has been presented Table 1.

3.2 Seasonal dynamics of mite *T. urticae*

In rabi summer fruit crop, mite incidence was recorded from the standard week 45 of November 2012 to 17 of April 2013. In Jumnal low mite incidence was noticed during 48 to 52 standard week (SW) and recorded 0.6±0.1to 9.7 ± 0.4 mites per sq inch. Population trend was in increasing with advancement of the season. The highest population trend was observed in 13 to 15th SW with 21.4 ± 1.2 to 25.5 ± 0.9 mites per sq inch. The mean incidence in the season was 13.7±7.8 at Vijayapura with range of 0.6±0.1 to 25.5 ± 0.9. Similarly at Atharga, low mite incidence was noticed during 46 to 51st standard week with a minimum of 0.6 ± 0.1 to 9.8 ± 0.9 mites per sq inch. The high range of population was observed in 13 to 17 standard weeks with 20 ± 0.1 to 24.9 ± 1.4 mites per sq inch. The seasonal mean was 14.6 ± 7.5 with range of 0.6 ± 0.1 to 24.9 ± 1.4per sq inch. Thus in both places (Jumnal and Atharga) the mite incidence was sizeable from January onwards (15 SW) with considerable increase in number consequently without any dwindling till the end of the season. Therefore the mite depredation was almost along with reproductive phase of the crop. Hence the population appeared to be detrimental to the crop.

3.3 Population dynamics of predatory mites *Euseius* sp.

In Jumnal incidence of predatory mite was noticed from 52nd SW with a low population of 0.1 ± 0.3 mites/leaf. The peak incidence was seen during 15 SW (3.4 ± 0.9 mites/leaf). Population trend was found increasing with increase in phytophagous mites' population. The mean incidence was 1.2 ± 0.6 per leaf with range of 0.1±0.3 to 3.4 ± 0.9 per leaf (Table 1). In Atharga also same trend was followed with respect to the incidence of predatory mites. The peak incidence of 3.2 ± 1.0 mites/leaf was noticed at 16th standard week. Predatory mites' population increases with increase in phytophagous mites. The mean population was 1.1 ± 0.6 with range of 0.1 ± 0.3 to 3.1 ± 1.3 per leaf.

3.4 Influence of abiotic factors and predatory mites on the incidence of *T. urticae* population

The relationship between *T. urticae* population and weather parameters as well as phytoseiid mite was assessed through simple correlation and regression studies. As presented in Table 2 at Jumnal, a significantly positive correlation was observed between *T. urticae* and maximum temperature (*r*= 0.852) and minimum temperature (*r*= 0.675). Whereas significantly negative correlation was found between *T. urticae* and morning relative humidity (*r*= -0.914) and evening relative humidity (*r*= -0.892). Significantly positive correlation was found between predatory miteand *T. urticae*(*r* = 0.913). All these factors governed the mite population to the tune of 91 per cent (R^2= 0.915) as revealed in Table 3.

In Atharga also (Table 4) there was significantly positive correlation was observed between *T. urticae* and maximum temperature (*r*= 0.804), whereas minimum temperature (*r* = 0.021) had non- significant effect. Further significantly negative correlation was found between *T. urticae* and morning relative humidity (r= -0.970) as well as evening relative humidity (*r*= -0.952). A non-significant correlation was found between *T. urticae* and rainfall (*r*= 0.235). Significantly positive correlation was found between predatory miteand *T. urticae* (*r*= 0.852) also. All these factors together

governed (Table 5) the mite population to the tune of 95 per cent (R^2= 0.95).

The first incidence of mite was observed during 48th standard week (November) with the low population of 0.6 ± 0.1 mites per square inch of leaf. The population gradually increased to 25.5 ± 0.9 and remained at higher level till end of the season. During this period the population ranged from 0.62 ± 0.1 to 25.5 ± 0.9. However, the seasonal mean incidence was 13.7 ± 7.8 per square inch in Jumnal. The seasonal dynamics of mites in Atharga was similar to that of Vijayapura. The mean incidence was 14.6 ± 7.5 per square inch with range of 0.62 ± 0.1 to 24.9 ± 1.4. The maximum mite activity was found from 15th to 17th standard week (23.9 ± 0.7 to 24.9 ± 1.4) and prevailed till the season end.

At both the places activity of predatory mite *Euseius sp.* was depending on its prey density. The first incidence of predatory mite was observed at 52nd and 51st standard weeks at Vijayapura and Atharga with 0.1 ± 0.3 and 0.13 ± 0.3 per leaf respectively. Maximum activity of predatory mites was observed during 15th and 17th standard week at both the places. The highest incidence of predatory mites recorded at Jumnal was 3.4 ± 0.9 (15th SW) and 3.1 ± 1.3 mites per leaf in Atharga.

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As polyphagous arthropod pest mites incidence is being widespread across conventional and newer hosts in recent past. The in-season abundance of pest coinciding with the reproductive stages would call for a serious depredations and yield loss. The phenomenon will be much pronounced in fruits/vegetables in a high input agriculture like grape ecosystem. It was striking in the present study that the incidence of phytophagous mites in grape started from November and reached peak by December. The mites activity was persisting till the harvest of crop i.e March. During all these months the prevailing temperature was high in the study locality as well as surrounding areas. Higher incidence of mites during high temperature (March/April 2005) in grape ecosystems of Andhra Pradesh has been quite evident [3]. It is also evident that mite population usually will be at its peak when temperature reaches 31.3 °C in okra ecosystem [5]. *T. urticae* dynamics appeared to be influenced positively with minimum as well as maximum temperature and negatively with relative humidity in cucumber growing conditions [6-7]. Further, in Brazil also *T. urticae* has been considered to be key pest of recent times which exhibits a similar low profile type of dynamics and pest-prey relationship with *Euseius citrifolius* Demark& Muma a predatory mite [4]. Thus from available reports it is clear that mite incidence likely to be highest in high temperature regimes. This was evident in the present investigation also. The low incidence of predatory population indicates limited possibilities of natural check over this emerging pest of grape. The dynamics revealed in the study localities as well as widespread infestations in North Karnataka warrants regular monitoring and management of mites in grape. Bio-efficacy experiments have indicated [8, 10] that newer acaricides viz., Hexythiazox 5.45 EC, Propargite 57 EC, Abamectin 1.9 EC could serve the purpose with higher economic returns.

Table 1: Population dynamics of *Tetranychus urticae* and predatory mite *Euseius* sp. at Jumnal and Atharga

	Jumnal		Atharga	
Year and Std Weeks	***T. urticae* / sq inch of leaf (± SD)**	**Predatory mites/leaf (± SD)**	***T. urticae* / sq inch of leaf (± SD)**	**Predatory mites/leaf (± SD)**
2012-45	-	-	-	-
46	-	-	0.6±0.1	-
47	-	-	3.3±0.4	-
48	0.6±0.1	-	5.5±1.3	-
49	3.3±0.6	-	5.0±0.5	-
50	5.1±0.6	-	8.3±1.1	-
51	7.5±0.5	-	9.8±0.9	0.1±0.3
52	9.7±0.4	0.1±0.3	10.4±0.5	0.1±0.3
2013-01	10.6±0.3	0.3±0.5	11.3±0.7	0.2±0.4
02	10.6±0.4	0.8±0.6	13.7±0.6	0.5±1.0
03	13.7±1.5	0.7±0.5	14.6±0.9	0.7±0.7
04	16.2±0.6	1.0±0.8	14.8±1.1	0.7±1.0
05	11.7±0.2	0.8±0.6	16.5±0.2	0.8±1.0
06	13.6±0.2	1.2±0.5	15.4±1.4	0.9±0.6
07	10.7±0.7	1.3±0.5	20.8±0.5	1.0±1.4
08	16.2±1.3	1.1±0.6	21.1±0.8	1.1±0.9
09	21.6±0.1	2.2±0.5	19.6±0.8	1.1±0.6
10	25.1±0.4	2.0±1.6	20.4±0.5	2.2±1.1
11	20.1±0.5	2.5±0.6	19.0±1.5	2.2±0.6
12	22.4±2.1	2.7±0.3	21.7±1.5	2.5±0.6
13	21.4±1.2	2.9±1.0	20.0±0.1	2.9±1.1
14	23.2±3.1	3.1±0.6	21.0±0.4	2.9±1.0
15	25.5±0.9	3.4±0.9	23.9±0.7	3.1±1.3
16	-	-	24.2±0.7	3.2±1.0
17	-	-	24.9±1.4	3.1±1.3
Mean	13.7±7.8	1.2±0.6	14.6±7.5	1.1±0.6

Table 2: Influence of abiotic factors and predatory mites on population of *Tetranychus urticae* at Jumnal

Mite pest	Temp Max.	Temp Min.	RH Morning.	RH Evening.	Rainfall	Predatory mite
Tetranychus urticae	0.852*	0.675*	-0.914*	-0.892*	-0.09	0.913*

* Significant at 5% Table '*r*' value = 0.36 (N=21) R^2 = 0.915

Table 3: Linear regression equation for Tetranychus urticae, abiotic factors and predatory mites at Jumnal

Parameters	Linear regression	R^2
Temp Max.	Y= 2.15X -57.72	0.727
Temp Min.	Y= 1.56X -13.62	0.456
RH Morning.	Y= -0.56X + 50.60	0.836
RH Evening	Y= -0.85X + 38.46	0.796
Rainfall	Y= -0.36X + 13.99	0.008
Predatory mite	Y=6.18X + 5.96	0.835
Over all	$Y= -1.84X_1 + 1.23X_2 + 0.06X_3 -0.78X_4 -0.42X_5+3.95X_6$	0.915

X_1 – Maximum temperature X_2 – Minimum temperature
X_3 – Morning relative humidity X – Evening relative humidity
X_5 – Minimum temperature X_6 –Predatory mite

Table 4: Influence of abiotic factors and predatory mites on population of *Tetranychus urticae* at Atharga

Mite pest	Temp Max.	Temp Min.	RH Morning.	RH Evening.	Rainfall	Predatory mite
Tetranychus urticae	0.804*	0.021	-0.970*	-0.952*	0.235	0.852*

* Significant at 5%, Table '*r*' value = 0.36 (N=25) R^2 = 0.956

Table 5: Linear regression equations for *Tetranychus urticae*, abiotic factors and predatory mites at Atharga

Parameters	Linear regression	R^2
Temp Max.	Y= 1.99X -51.10	0.647
Temp Min.	Y= 0.03X +13.96	0.0004
RH Morning.	Y= -0.63X + 54.43	0.941
RH Evening	Y= -0.85X + 42.08	0.907
Rainfall	Y= 3.60X + 14.12	0.055
Predatory mite	Y= 5.41X + 8.25	0.727
Over all	$Y= 0.33X_1-0.11X_2 - 0.50X_3 -0.34X_4 - 0.17X_5-1.93X_6$	0.956

X_1 – Maximum temperature X_2 – Minimum temperature
X_3 – Morning relative humidity X_4– Evening relative humidity
X_5 – Minimum temperature X_6 –Predatory mite

4. References

1. Anonymous. Indian Horticulture Database, National Horticulture Board, 2011. www.nhb.gov.in
2. Bournier A. Grape insects. Annual Review Entomology, 1977; 22:355-376.
3. Chandra Sekhar D, Jagdishwar Reddy D, Rahman SJ, Ranga Reddy A, Narendranath VV. Ecology and management of red spider mite, Tetranychus urticae Koch on grape, Acta Horticulturae 2008; 785:335-347.
4. Cleiton A, Domingos José WS, Melo José EM, Oliveira, Manoel GC, Gondim Jr. Mites on grapevines in northeast Brazil: occurrence, population dynamics and within-plant distribution, International Journal of Acarology. 2014; 40(2):145-151.
5. Dhar T, Dey PK, Sarkar PK. Influence of abiotic factors on population buildup of red spider mite, *Tetranychus urticae* on okra vis-a-vis evaluation of some new pesticides for their control. Pestology 2000; 24(9):34-37.
6. Kanika, Gulati R, Geroh M. Influence of abiotic stresses on the population dynamics of two spotted spider mite (Tetranychus urticae Koch) in cucumber ecosystem. Annals of Plant Protection Sciences 2013; 21(2):242-246.
7. Kanika, Gulati R, Geroh M. Impact of weather parameters on the population dynamics of Tetranychus urticae Koch on field grown cucumber. Annals of Biology 2014; 30(1):140-145.
8. Karabhantanal SS, Udikeri SS, Vastrad SM, Wali SY. Bio efficacy of different acaricides against red spider mite, *Tetranychus urticae* on grapes. Pest Management in Horticulture Ecosystem 2012; 18(1):94-97.
9. Veerendra AC, Udikeri SS, Karabhantanal SS. Comparative biology of two spotted spider mite, *Tetranychus urticae* Koch (Acariformes: Tetranychidae) on grape and mulberry, Karnataka Journal of Agricultural Science. 2014; 27(3):351-352.
10. Veerendra AC, Udikeri SS, Karabhantanal SS. Bio-efficacy, yield loss and economics of two spotted spider mite *Tetranychus urticae* Koch (Acarina: Tetranychidae) management through synthetic acaricides and biorationals in grape vineyards. Karnataka, International Journal of Current Research in Biosciences and Plant Biology. 2015; 2(5):130-140
11. Wadhi SR, Batra HN. Pests of tropical and subtropical fruit trees. In Entomology in India, Ed. Pant, N.C., The Entomological Society of India, New Delhi, 1964, 227-260.