International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(2): 1234-1236

Received: 09-01-2019
Accepted: 13-02-2019

Patel RK
Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University Navsari, Gujarat, India

Ghetiya LV
Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University Navsari, Gujarat, India

Correspondence
Patel RK
Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University Navsari, Gujarat, India

Efficacy of entomopathogenic fungi *Fusarium verticillioides* (Saccardo) Nirenberg against *Tetranychus urticae* Koch on okra in polyhouse

Patel RK and Ghetiya LV

Abstract
Studies on efficacy of acaropathogenic fungi *F. verticillioides* against *T. urticae* on okra was conducted in polyhouse at Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) India. The six different concentrations of *F. verticillioides* ranging from 1×10^5cfu/ml to 1×10^{10}cfu/ml were evaluated against *T. urticae* on okra. Among the different treatments, *F. verticillioides* @ 1×10^{10}cfu/ml concentration was found significantly superior with highest (75.04%) mortality at 10 days after application. Whereas, lowest (26.41%) mortality was observed @ 1×10^5cfu/ml concentration.

Keywords: *Fusarium verticillioides*, *Tetranychus urticae*, two spotted red spider mite, okra

Introduction
Two spotted red spider mite, *Tetranychus urticae* Koch is one of the most imperative polyphagous species of the family Tetranychidae, attacking several agri-horticultural crops and causing economic damage. They make extensive webbing over the whole plants. Moderate population may significantly affect crop production and heavy infestation results in death of the plant (Jeppson *et al*., 1975) [1]. The two spotted red spider mite, *T. urticae* remains active throughout the year under protected cultivation as well as in open field condition. It cause serious damage in various crops and extent of losses is reported as 10 to 15, 15 to 20, 10 to 25, 13 to 31, 20 to 25 and 27 to 39 per cent losses in rice, tea, sugarcane, brinjal, okra and chilli, respectively (Rachna, 2004) [2].
In modern agriculture, management of red spider mites in okra by chemical acaricides is becoming ineffective and expensive due to development of resistance to most of the acaricides in a short time. Hence, there is a need to develop an effective and sustainable control measure for *T. urticae*. In theory, acari make good host for fungal pathogens because they have generally soft body and many inhabit environment with humid micro-climates that favours infection and disease transmission (Hajek and Leger, 1994) [3].
Testing the efficacy of *F. verticillioides* as newer acaropathogen with different dosages against *T. urticae* on okra in polyhouse is essential.

Materials and Methods
Preparation of suspension
The conidial suspension for testing the efficacy of *F. verticillioides* at different doses was obtained from 18 to 21 days old culture of *F. verticillioides* basal medium. The fungal mat (12g) of saboured dextrose broth media with homogenous fungal growth from the culture medium was suspended thoroughly in 70ml sterilized distilled water containing 0.1 per cent Tween- 80 by using a rotary mixture for 20 minutes. Homogenous solution then filters through double layer muslin cloth. The filter was made up to 100ml by adding sufficient quantity of sterilized distilled water. An improve Neubauer's haemocytometer was used to fix the concentration of fungal suspension ranging from 1×10^5 to 1×10^{10}cfu/ml.

Method of Application
Treatments were imposed with the help of hand atomizer at once coinciding with peak incidence and uniform development of mites in experimental units.

Methods of observations

Population of mites (active stages) were recorded from three randomly selected and tagged leaves representing top, middle and lower canopy of the plant. The two-spotted red spider mite density (all stages together) was recorded from one square centimetre leaf area with the use of magnifying lens (10X) utilised by diamond workers. Pre-treatment counts a day before treatment and post- treatment counts at 2, 4, 6, 8 and 10 days after application of treatment was recorded. The mites showing growth of fungus on body was considered dead.

Statistical analysis

The data so obtained on mite counts were summed up and utilized for calculation of mortality. The corrected mortality was worked out through utilizing following formula suggested by Henderson and Tilton (1955) [4].

$$\text{Corrected mortality (\%)} = 1 - \frac{\text{Ta x Cb}}{\text{Tb x Ca}} \text{ x } 100$$

Where,

Tb = Number of mite observed before treatment

Ta = Number of mite observed after treatment

Cb = Number of mite observed from untreated control plot before treatment

Ca = Number of mite observed from untreated control plot after treatment

The data so obtained were statistically analyzed using Completely Randomized Block Design after arcsine transformation so as to evaluated effectiveness of pesticides against two spotted red spider mite, *T. urticae* (Steel and Torrie, 1980) [5].

Results and Discussion

F. verticillioides ranging from 1×10^5cfu/ml to 1×10^{10}cfu/ml were evaluated for their effect on *T. urticae* on potted okra in polyhouse. The results obtained are presented in Table 1 and depicted in Fig.1.

Two days after spray

The *F. verticillioides* @ 1×10^{10}cfu/ml concentration was found significantly superior with highest (23.37%) mortality of *T. urticae* over rest of the concentrations followed by 1×10^9cfu/ml (14.04%), which was at par with 1×10^8cfu/ml (12.55%). However, mortality of mites were decreasing in trend with decreasing concentration of *F. verticillioides* in rest of the treatments *viz*. 5.51, 3.88 and 2.12 per cent at 1×10^7, 1×10^6 and 1×10^5cfu/ml respectively, at two days after spray. The descending order of the mortality of *T. urticae* was T6 > T5 ≥ T4 > T3 ≥ T2 > T1 at 2 DAS.

Four days after spray

The mortality of mites was moderately increased in all the treatments after four days of application. The maximum (48.03%) mortality of mites was recorded at 1×10^{10}cfu/ml, which was at par with 1×10^9cfu/ml (46.06%) and 1×10^8cfu/ml (44.47%). The minimum (9.48%) mortality of mites was recorded at 1×105cfu/ml, which was remained at par with 1×10^6cfu/ml (14.29) following 1×10^7cfu/ml (24.78%). The descending order of the mortality of *T. urticae* was T6 ≥ T5 ≥ T4 > T3 > T2 ≥ T1 at 4 DAS.

Six days after spray

The mortality percentage was slightly increased in 1×10^{10}cfu/ml and recorded the highest (51.37%) mortality at 6 DAS, which was remained at par with 1×10^9cfu/ml (49.66%) and 1×10^8cfu/ml (47.70%). The mortality of mites was reduced with reduction in dose of the acaropathogen. The least (13.73%) mortality was found in 1×10^5cfu/ml, which was remained at par with 1×10^6cfu/ml (18.81%) following 1×10^7cfu/ml (35.62%) at 6 DAS. The descending order of the mortality of *T. urticae* was T6 ≥ T5 ≥ T4 > T3 > T2 ≥ T1 at 6 DAS

Eight days after spray

The mortality of mites was considerably increased in 1×10^{10}cfu/ml (65.19%) at 8 DAS showing significant superiority, which was remained at par with 1×109cfu/ml (63.24%). Whereas, lowest (20.29%) mortality of mites was observed in 1×10^5cfu/ml at 8 DAS following 1×10^5cfu/ml (31.22%) and 1×10^6cfu/ml (51.10%). The descending order of the mortality of *T. urticae* was T6 ≥ T5 ≥ T4 ≥ T3 ≥ T2 > T1 at 8 DAS

Ten days after spray

At 10 DAS, the maximum (75.04%) mortality was observed at concentration of 1×10^{10}cfu/ml that was remained at par with 1×10^9cfu/ml with 69.64 per cent mortality of mites. The mortality was in decreasing trend *viz*., 68.13, 59.62 and 40.44 at 1×10^8, 1×10^7 and 1×10^6cfu/ml. However, minimum mortality was observed at 1×10^5cfu/ml (26.41%) The descending order of the mortality of *T. urticae* was T6 ≥ T5 ≥ T4 ≥ T3 ≥ T2 > T1 at 10 DAS

The present findings in corroboration with work done by earlier workers; Aghajanzadeh *et al.* (2006) [6] tested *H. thompsonii* on mosambi (*Citrus reticulata*) against *T. urticae* Manushi *et al*. (2008) [7] tested *F. pallidoroseum* against gypsy moth on eastern cottonwood; Seiedy *et al.* (2010) [8] on cucumber (*Cucumeris sativus*) and Geroh *et al.* (2014) [9] on potted okra tested *B. bassiana* against *T. urticae.* Similarly, Kalmath *et al.* (2012) [10] tested *H. thompsonii* against coconut mite. All have been reported increasing trend of mortality with increased concentration and time period after application of entomopathogens.

Table 1: Efficacy of *F. verticillioides* against *T. urticae* on okra

Treatment	Concentration cfu/ml	Mortality of mites (%)				
		2 DAS	4 DAS	6 DAS	8 DAS	10 DAS
T_1	1×10^5	8.26^{d*} (2.12)	17.58^{c} (9.48)	21.33^{c} (13.73)	26.58^{d} (20.29)	30.77^{d} (26.41)
T_2	1×10^6	10.82^{cd} (3.88)	22.13^{c} (14.29)	25.64^{c} (18.81)	33.89^{c} (31.22)	39.77^{c} (40.44)
T_3	1×10^7	13.41^{c} (5.51)	29.81^{b} (24.78)	36.61^{b} (35.62)	45.63^{b} (51.10)	50.56^{b} (59.62)
T_4	1×10^8	20.72^{b} (12.55)	41.82^{a} (44.47)	43.67^{a} (47.70)	51.94^{ab} (61.94)	55.67^{ab} (68.13)
T_5	1×10^9	21.84^{b} (14.04)	42.74^{a} (46.06)	44.80^{a} (49.66)	52.71^{a} (63.24)	56.67^{ab} (69.64)
T_6	1×10^{10}	28.88^{a} (23.37)	43.87^{a} (48.03)	45.79^{a} (51.37)	53.87^{a} (65.19)	60.09^{a} (75.04)
	S.Em.±	1.64	1.49	1.99	2.05	2.01
	CD at 5%	5.04	4.60	6.13	6.32	6.20
	CV%	16.36	7.84	9.50	8.06	7.13

*Figures are angular transformed values Figures in the parentheses are original value

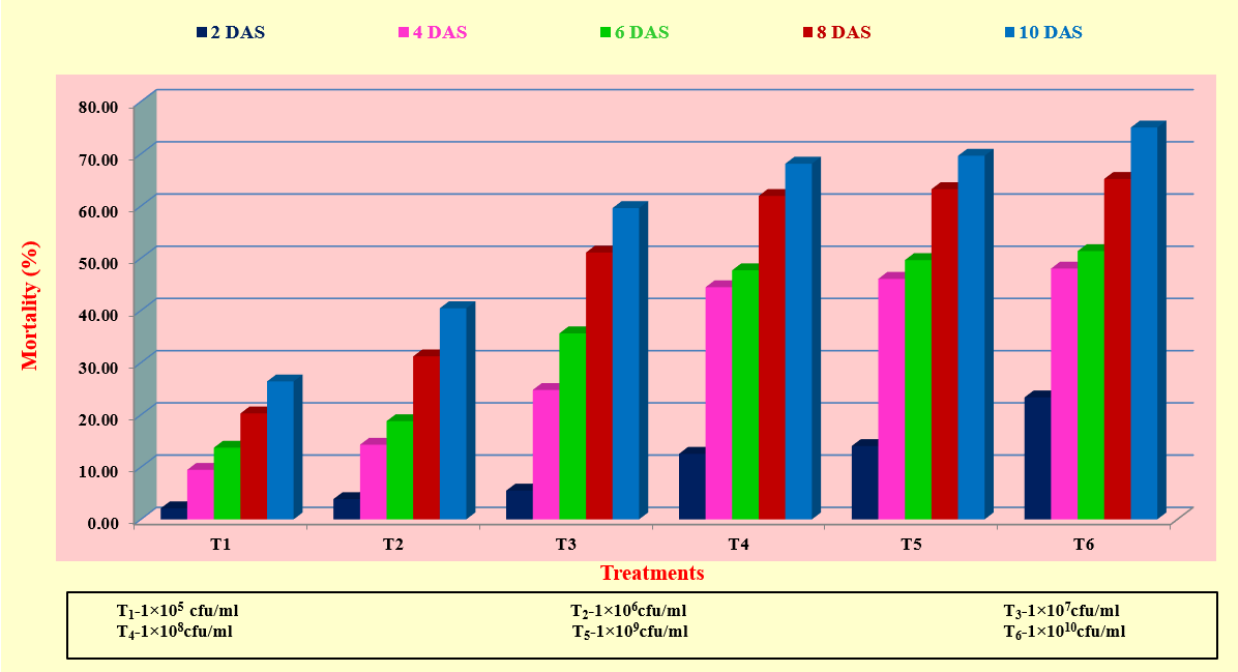

Fig 1: Efficacy of *F. verticillioides* against *T. urticae* on okra

Conclusion

All the concentrations of *F. verticillioides* against *T. urticae* applied on potted okra under polyhouse condition showed significantly higher mortality was observed at concentration of 1×10^{10}cfu/ml, whereas minimum mortality was observed in 1×10^{5}cfu/ml at ten days after spray. The mortality of *T. urticae* was increased with increasing concentration of *F. verticillioides*.

Acknowledgement

Authors are highly thankful to Navsari Agricultural University, Navsari (Gujarat) for providing necessary facilities for conducting this trial.

References

1. Jeppson LR, Keifer HH, Baker EW. Mites injurious to economic plants. Uni. California Press, 1975, 614.
2. Rachna G. Incidence of *Tetranychus cinnabarinus* (Boisd.) infestation in different varieties of *Abelmoschus esculentus* L. Annals of Plant Protection Science. 2004; 12(1):45-47.
3. Hajek AE, St Leger Rl. Interactions between fungal pathogens and insect hosts. Annual Review of Entomology. 1994; 39:293-322.
4. Henderson CF, Tilton EW. Test with acaricides against the brown wheat mite. Journal of Economic Entomology. 1955; 48(2):157-161.
5. Steel RGD, Torrie JH. Principles and Procedures of Statistics: A Biometrical Approaches, Second Edition. McGraw-Hill, New York, 1980, 633.
6. Aghajanzadeh S, Malik B, Chandrashekar SC. Bioefficacy of six isolates of *Hirsutella thompsonii* Fisher against Citrus rust mite, *Phyllocoptruta oleivora* Ashmead (Acari: Eriophyidae) and Two spotted spider mite *Tetranychus urticae* Koch (Acari: Tetranychidae). Pakistan Journal of Biological Sciences. 2006; 9(5):871-875.
7. Manushi NA, Hussain B, Malik GN. Yousuf M and Fatima N. Efficacy of entomopathogenic fungus *Fusarium pallidoroseum* (Cooke) Sacc. Against Gypsy moth (*Lymantria obfuscate* Walker). Journal of Entomology. 2008; 5(1):59-61.
8. Seiedy M, Saboori A, Allahyari H, Hassanloui RT, Tork M. Laboratory investigation on the virulence of two isolates of the Entomopathogenic fungus *B. bassiana* against the two spotted spider mite *T. urticae* (Acari: Tetranychidae). International Journal of Acarology. 2010; 36(6):527-532.
9. Geroh M, Gulati R, Kanika. *Beauveria bassiana* (Balsamo) vuillemin (STRAIN ITCC- 4668) as acaricide against *Tetranychus urticae* Koch (Acari: Tetranychidae). Indian Journal Agricultural Research. 2014; 48(5):384-388.
10. Kalmath B, Mallik B, Onkarappa S, Girish R, Srinivasa N. Isolation, genetic diversity and identification of a virulent pathogen of eriophyid mite, *Aceria guerreronis* (Acari: Eriophyidae) by DNA marker in Karnataka, India. African Journal of Biotechnology. 2012; 11(104):16790-16799.