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Research Article

Natural epizootics of *Cladosporium cladosporioides* on *Tetranychus urticae* Koch. (Acari.: Tetranychidae) in Coimbatore

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ABSTRACT: Investigations on the natural epizootics of *Cladosporium cladosporioides* (Fresenius) de vries were carried out on Okra grown at Tamil Nadu Agricultural University, Coimbatore during 2010 and 2011. Observations on the incidence of mycosed mites were monitored continuously on okra at weekly interval during the study period. Occurrence of mycosis on *Tetranychus urticae* Koch due to *C. cladsoporioides* was high during third week of August 2010 (67.58%) followed by first week of August 2011 (47.24%), respectively. Fungal infection on mites had significant positive correlation with relative humidity and negative correlation with sunshine hours during the study period. An epizootic incidence of *Cladosporium cladosporioides* recorded on *T. urticae* is the first report from Coimbatore, Tamil Nadu.

KEY WORDS: Epizootics, *Cladosporium cladosporioides*, *Tetranychus urticae*, okra, weather factors

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INTRODUCTION

The two spotted spider mite, *Tetranychus urticae* Koch is a serious pest of vegetable crops causing heavy yield loss upto 48 per cent (Srinivasa and Sugeetha, 1999). Management of the mite pests mainly relies on sprays of chemical acaricides. *T. urticae* is notorious for its ability to rapidly develop resistance to chemicals. Efforts to use entomopathogenic fungi as a component in insect pest management is of recent interest to exploit them, besides understanding their natural course of action in insect population regulation. Mycosis in insects is common, wide spread and often decimates insect populations in spectacular epizootics (Hajeck and Leger, 1994). Entomopathogenic fungi are significant pathogens of the sucking insects (Humber, 1981), and many fungal species are responsible for epizootics that often successfully regulate pest population (Lacey *et al.,* 2001). *Beauveria bassiana* (Balsamo) Vuillemin, *Metarhizium anisopliae* (Metchinkoff) Sorokin, *Lecanicillium lecanii* (Zimm.) Viegas, *Paecilomyces fumosoroseus* (Holmsk) Fries, *Hirsutella thompsonii* (Fisher) and *Neozygites floridana* Weiser and Muma often play an important role in decreasing native populations of phytophagous mites (Chandler *et al.,* 2000). Recently, natural occurrence of *Cladosporium cladosporioides* (Fresenius) de vries on *T. urticae* has been reported from Tamil Nadu (Jeyarani *et al.,* 2011). Epizootics of the *C. cladosporioides* has been seen on Tamil Nadu Agricultural University campus, Coimbatore during two successive years on 2010 and 2011. Natural epizootics of *C. cladosporioides* on *T. urticae* in Coimbatore is discussed in this paper.

MATERIALS AND METHODS

Weekly survey was undertaken during 2010 and 2011 to record the occurrence of entomopathogenic fungi associated with *T. urticae* on okra cultivated in eastern block of Tamil Nadu Agricultural University, Coimbatore. Dead mites which were suspected to have fungal infection were periodically collected from the field and kept on moist filter paper in Petri dish for further mycelial growth and sporulation. Mite cadavers showing natural external growth of fungi were carefully transferred using a sterile camel hairbrush to sterilized Petri dishes containing Sabouraud's Maltose Agar enriched with one per cent yeast extract (SMAY) media and incubated at 28±1°C. After 48 h of inoculation, the fungi were transferred to SMAY slants by hyphal tip method and further the pathogens were sub cultured for purification. Pathogenicity of the fungi isolated from the mites was established by spraying the spore suspensions on healthy mite colonies. The fungi were reisolated from the dead mites and compared with the original culture. Pure cultures of the fungal isolates were

identified at the Division of Plant Pathology, Indian Agricultural Research Institute, New Delhi.

Epizootic incidence of *C. cladosporioides* on *T. urticae* was recorded on okra (var. Mahyco 10.) grown at TNAU campus from August to December during 2010 and 2011. Observations on the incidence of mycosed mites were monitored continuously on okra at weekly intervals until the crop senescence. Ten plants were selected at random and the live and mycosed mites per 4 cm² area were counted from three leaves representing top, middle and bottom areas of each plant using 10x hand lens and the per cent mycosis was worked out.

To establish the relationship between the mycosis of *T. urticae* and weather parameters, the mycosis per cent was correlated with weather parameters like temperature, relative humidity, rainfall and sunshine hours. The weather data on maximum, minimum temperature, relative humidity and rainfall recorded during the above period were obtained from Department of Agroclimatic Research centre, TNAU, Coimbatore.

RESULTS AND DISCUSSION

Incidence of *C. cladosporioides* on *T. urticae*

Fungal pathogen collected from mycosed *T. urticae* was confirmed as *C. cladosporioides* (ITCC No. 8015) at Division of Plant Pathology, Indian Agricultural Research Institute, New Delhi. Natural occurrence of *C. cladosporioides* on *T. urticae* infesting okra was observed throughout the cropping period and the per cent infection was presented in Table 1. Mycosed mites were inactive, firmly attached to the leaf surface and covered with a dull green coloured spores. Putatively infected mites were observed under the microscope to confirm *C. cladosporioides* infection.

Natural occurrence of entomopathogenic fungi could give a regular and tremendous mortality of the pests (Steinhaus, 1949). Natural occurrence of *C. cladosporioides* was observed in 2010 and 2011 with different infection rates (Table 1). During 2010, the disease prevailed from 33rd to 51st standard week (August to November) in the range of 67.58 to 17.84 per cent.

Table 1. Epizootic occurrence of *Cladosporium cladosporioides* on *Tetranychus urticae* in okra during 2010-2011

Period	Standard Week	Year- 2010			Period	Standard Week	Year- 2011		
		Total Mites	No. of mycosedmites	Mycosed mites (%)			Total Mites	No. of mycosed mited	Mycosed Mites (%)
21-Aug	33	180.14	121.65	67.58	8-Aug	31	97.04	45.82	47.24
28-Aug	34	161.24	68.51	42.55	15-Aug	32	112.28	40.57	36.22
4-Sep	35	132.14	63.70	48.26	22-Aug	33	102.65	41.79	40.97
11-Sep	36	140.25	77.63	55.45	29-Aug	34	96.14	34.76	36.21
18-Sep	37	109.57	54.75	50.23	5-Sep	35	57.21	18.31	32.12
25-Sep	38	73.28	29.51	40.43	12-Sep	36	83.45	33.64	40.53
1-Oct	39	71.45	34.01	47.91	19-Sep	37	68.14	29.07	42.75
8-Oct	40	56.87	32.35	57.77	26-Sep	38	42.53	8.08	19.24
14-Oct	41	40.51	18.57	46.43	3-Oct	39	21.77	4.62	22.04
22-Oct	42	17.48	3.032	17.84	10-Oct	40	14.48	2.62	18.76
29- 0ct	43	22.58	8.40	38.21	17-Oct	41	42.22	5.35	12.74
5-Nov	44	40.29	23.82	59.57	24-Oct	42	20.15	3.44	17.21
12-Nov	45	32.47	16.00	50.02	31-Oct	43	15.34	0.63	4.21
19-Nov	46	54.39	23.14	42.86	7-Nov	44	12.96	0.25	2.14
27-Nov	47	30.48	13.16	43.87	14-Nov	45	18.24	0.00	0.00
3-Dec	48	16.14	9.01	56.34	21-Nov	46	18.15	0.00	0.00
10-Dec	49	19.17	8.36	44.12	28-Nov	47	15.42	0.00	0.00
17-Dec	50	24.83	7.97	33.22	5-Dec	48	7.05	0.00	0.00
24-Dec	51	17.22	3.03	17.88	12-Dec	49	0.00	0.00	0.00
31-Dec	52	24.10	0	0	17-Dec	50	0.00	0.00	0.00
	Mean	63.23	31.00	43.02			46.96	15.01	26.60

In the year of 2011, the disease prevailed from 31st to 44th week, it ranged between 47.24 and 2.14 per cent. Maximum fungal infection was recorded during the third week of August 2010 (67.58%) and first week of August 2011 (47.24%), respectively (Table 1). Infection level remained high only during August and September months in both the years. The average infection level was 43.02 and 26.60 per cent during 2010 and 2011, respectively.

Farais and Filho (1987) found that *Cladosporium* spp. was the most important fungus isolated from nymphs of *Aleurothrixus aepium* in cassava plants. Similarly, Bakey (2000) observed the natural occurrence of *C. cladosporioides* on whiteflies all around the year with different infection rates of 44.38 and 42.24 per cent during 1998 and 1999, respectively in Egypt.

Relationship between disease and weather factors

To establish relationship between the mycosis of two spotted spider mites and weather parameters, the mycosis percentage was correlated with weather parameters *viz.*, temperature, relative humidity (RH), rainfall and sunshine hours (Table 2). This consequence relationship of fungus infection under field condition might be utilized in controlling the pests. Fungal infection on mites had significant positive correlation with maximum RH (r = 0.474*) in the first year (2010) and it was negatively correlated with minimum RH (r= –0.548*) in the second year (2011) of the study. Negative correlation was observed in sunshine hours with per cent mycosis in both years. Other factors, *viz*., temperature and rainfall had no significant impact on mycosis (Table 2).

Multiple linear regression analysis revealed the influence of weather parameter on the mycosis of mites was 50.4 per cent (2010) and 68.2 per cent (2011) (Table 3).

The multiple linear regression equation fitted for mycosis and weather parameters are

$$Y_1 = -53.72 + 4.86\ X_1 + 3.04\ X_2 + 3.52\ X_3 + 0.60\ X_4 - 0.05\ X_5 - 0.18\ X_6 + 0.504$$

$$Y_2 = -87.09 + 2.90\ X_1 - 0.55\ X_2 + 1.07\ X_3 - 0.56\ X_4 - 2.92\ X_5 - 0.57\ X_6 + 0.682$$

The results revealed that an increase in maximum temperature by 1°C, would increase the mycosis mite population by 4.86 and 2.90 per cent during 2010 and 2011, respectively. An increase in the relative humidity by 1% would lead to an increase of 3.52 and 1.07 per cent mycosis in the year 2010 and 2011, respectively.

Table 2. Correlation between natural occurrence of *Cladosporium cladsporioides* on *Tetranychus urticae* and weather parameters

Year	Temperature (°C)		Relative humidity (%)		Rainfall (mm)	Sunshine (h)
	Max.	Min.	Max.	Min.		
2010	0.117	0.303	0.474*	0.388	-0.265	-0.447*
2011	0.109	0.280	0.344	-0.548*	-0.162	-0.661**

Table 'r' value at 1% - 0.561

Table 'r' value at 5% - 0.444

**= significant at P < 0.05 level *= significant at P< 0.01 level.

Table 3. Multiple regression coefficient of mycosis of *Tetranychus urticae* with weather parameters

Year	Intercept	Temperature (°C)		Relative humidity(%)		Rainfall (mm)(X_5)	Sunshine (h)(X_6)	r^2
		Max.(X_1)	Min. (X_2)	Max.(X_3)	Min. (X_4)			
2010	-53.72	4.86	3.04	3.52	0.60	-0.05	-0.18	0.504
2011	-87.09	2.90	-0.55	1.07	-0.56	-2.92	-0.57	0.682

$Y_1 = -53.72 + 4.86X_1 + 3.04\ X_2 + 3.52\ X_3 + 0.60\ X_4 - 0.05X_5 - 0.18\ X_6 + 0.504$

$Y_2 = -87.09 + 2.90X_1 - 0.55\ X_2 + 1.07\ X_3 - 0.56\ X_4 - 2.92X_5 - 0.57\ X_6 + 0.682$

The differential occurrence of mycosis of mites may be attributed to the perpetual condition of spores and the conducive weather conditions. The fungus prevalence in the field was found associated with the favourable environmental conditions during the period from August to December (Temperature = 26.33 and 25.60°C and RH = 76 and 78.55%) in both years respectively. Epizootic incidence of *Cladosporium cladosporioides* recorded on *T. urticae* is the first report from Coimbatore, Tamil Nadu.

The fungal incidence was found to be associated with the favourable environmental conditions especially with the maximum and minimum RH to cause epizootic. The results are in agreement with a number of studies, seasonal occurrence of *Nomurea rileyi* (Farlow) Samson on *Helicoverpa armigera* (Hubner) (Ramegowda *et al.*, 2010), epizootic incidence of *Entomopthora* sp., on mango leaf hopper (Ganga visalakshy *et al.*, 2010) showed the natural field epizootics followed the periods of high rainfall or relative humidity that favoured the disease outbreak with ambient moisture (Hajeck and St Leger, 1994; Carrurhers *et al.*, 1997). From the present study, it can safely be interpreted that the disease development is dependent on the pathogen inoculum and climatic conditions. Though, several studies have been conducted on many fungal pathogens, this study presented the epizootic occurrence of *C. cladosporioides* in okra system for the first time in Tamil Nadu. Eventhough, *C. cladosporioides* is widely considered as a opportunistic fungi, this can also play a vital role in the natural suppression of *T. urticae* population to some extent. Further studies on this pathogen would help to understand its impact in natural regulation of *T. urticae.*

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