



## INFLUENCE OF TRICHOMES ON THE INCIDENCE OF TWO SPOTTED SPIDER MITE *TETRANYCHUS URTICAE* ON BRINJAL

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### ABSTRACT

The present study evaluates the effect of host plant resistance by antixenosis (trichomes) in 40 brinjal entries to the two spotted spider mite *Tetranychus urticae* Koch, an important pest of brinjal. The maximum trichome density was observed (719.15/ 0.5cm<sup>2</sup> leaf area) with the variety Namakkal local and minimum (276.82/ 0.5cm<sup>2</sup> leaf area) was with Tiruppur local. Stellate type of trichomes were observed on all the entries, with maximum length on the upper surface of the leaves being 200.18 µm on Namakkal local, and on lower surface of leaves (269.36 µm) on Chinthapalli local-2. Manapparai local measured 247.40 µm long on midrib and 206.84 µm on veins. The correlation coefficients between the trichome density, length and *T. urticae* incidence revealed a significant negative correlation. Arka Nidhi was found to be resistant (2.07/ cm<sup>2</sup> leaf area) with low trichome density (427.50 µm).

**Key words:** *Tetranychus urticae*, brinjal, varietal resistance, leaf trichomes, upper and under surface, density, length, antixenosis, correlation coefficients

The brinjal *Solanum melongena* L. is cultivated in an area of 728.0 lakh ha with the annual production of about 126.60 lakh tonnes in India (Anonymous, 2018). This crop is attacked by more than eleven species of spider mites (Gupta, 1985). Among these, the two spotted spider mite *Tetranychus urticae* Koch is an extremely polyphagous and serious pest of at least 150 economically important crops including brinjal (Jeppson et al., 1975). It causes an estimated yield loss of 26.94 to 64.93% during severe infestation (Shukla et al., 2017). The host plant resistance through antixenosis results from the physical barrier of the plant that reduces the interaction between plant and herbivore (Gowthish et al., 2018). Ayyanar (2017) reported that the trichome density and length in brinjal had a negative impact on the incidence of sucking pests especially mites and observed that trichomes will hinder their movement and feeding. Jayabal et al. (2017) and Sheeba (2010) also confirmed these exhibiting a negative impact on the mites in okra varieties. The host plant resistance can be an important component to manage *T. urticae*. Hence, the present study evaluated the impact of trichome density and length in brinjal entries.

### MATERIALS AND METHODS

Seed materials including released popular varieties,

hybrids and local land races were collected from the Department of Olericulture, Horticultural College and Research Institute, TNAU, Coimbatore; Annamalai University, Chidambaram; Vegetable Research Station, TNAU, Palur; Department of Vegetable Science, College of Horticulture, KAU, Vellanikkara and Indian Institute of Horticultural Research, Bengaluru; National Seeds Corporation (NSC). Local popular land races were obtained from the farmers directly and the popular hybrids were procured from seed companies. The seeds were sown in mud pots of convenient size for screening under in-vitro conditions. The screening was carried out in a polyhouse located in orchard of the Department of Horticulture, AC&RI, Madurai adopting CRD design with two replications. The trichome density and length were assessed after sufficient population buildup and damage symptoms. In the experiment, the plants were infested with 30 mites on 25<sup>th</sup> day after transplanting @ one seedling/ pot. The mite incidence was assessed at 10 days interval after inoculation, and continued till the incidence is nil. Mite counts were made from the top, middle and bottom leaves of each plant, in 1 cm<sup>2</sup> area and the means were subjected to statistical analysis.

The trichome density from the leaf lamina, midrib and veins of all the entries were assessed adopting the methodology suggested by Maite et al. (1980). The

Table 1. Screening of brinjal entries for resistance to *T. urticae*

S. No.	Entries	Mite incidence/ cm <sup>2</sup> leaf area	Trichome length (µm)				No. of trichomes/ 0.5 cm <sup>2</sup> area of leaf
			Upper surface	Lower surface	Midrib	Veins	
1	Ariyalur local-1	7.42 (2.81) <sup>ef</sup>	152.52 (12.37)	202.48 (14.25)	172.41 (13.15)	181.85 (13.50)	560.98 (23.70)
2	Ariyalur local-2	16.22 (4.09) <sup>ijkl</sup>	120.76 (11.01)	160.20 (12.68)	135.96 (11.68)	158.39 (12.61)	372.75 (19.32)
3	Arka Anand	3.27 (1.94) <sup>b</sup>	164.33 (12.84)	232.75 (15.27)	216.68 (14.74)	193.35 (13.92)	680.07 (26.09)
4	Arka Harshitha	7.28 (2.79) <sup>def</sup>	156.75 (12.54)	205.53 (14.35)	192.51 (13.89)	183.63 (13.57)	553.32 (23.53)
5	Arka Keshav	6.82 (2.71) <sup>cde</sup>	155.20 (12.48)	209.50 (14.49)	180.15 (13.44)	184.50 (13.60)	540.00 (23.25)
6	Arka Nidhi	2.07 (1.60) <sup>a</sup>	186.65 (13.68)	232.57 (15.27)	210.22 (14.52)	201.94 (14.23)	427.50 (20.69)
7	Annamalai-1	17.9 (4.29) <sup>m</sup>	123.50 (11.14)	162.25 (12.76)	149.75 (12.26)	151.79 (12.34)	365.32 (19.13)
8	Bhavani local	6.55 (2.66) <sup>cd</sup>	159.78 (12.66)	227.60 (15.10)	205.66 (14.36)	192.05 (13.88)	588.00 (24.26)
9	CO-2	16.32 (4.10) <sup>ijkl</sup>	122.78 (11.1)	162.00 (12.75)	147.54 (12.17)	157.80 (12.58)	388.75 (19.73)
10	Chinthapalli local-1	7.40 (2.81) <sup>ef</sup>	157.43 (12.57)	217.58 (14.77)	199.95 (14.16)	181.57 (13.49)	574.98 (23.99)
11	Chinthapalli local-2	2.25 (1.66) <sup>a</sup>	166.21 (12.91)	269.36 (16.43)	247.03 (15.73)	203.50 (14.28)	703.77 (26.54)
12	Gottivada local	14.27 (3.84) <sup>i</sup>	130.00 (11.42)	157.25 (12.56)	151.30 (12.32)	161.30 (12.72)	377.33 (19.44)
13	Guntur local-1	15.47 (4.00) <sup>j</sup>	106.52 (10.34)	159.30 (12.64)	144.56 (12.04)	153.70 (12.42)	379.17 (19.49)
14	Guntur local-2	17.37 (4.23) <sup>lm</sup>	111.48 (10.58)	136.65 (11.71)	124.55 (11.18)	126.79 (11.28)	349.87 (18.72)
15	Haritha	7.48 (2.82) <sup>ef</sup>	148.65 (12.21)	228.13 (15.12)	169.57 (13.04)	186.99 (13.69)	550.25 (23.47)
16	Irapaduguda local	16.30 (4.10) <sup>ijkl</sup>	125.95 (11.24)	158.85 (12.62)	149.67 (12.25)	158.84 (12.62)	328.33 (18.13)
17	Kovilpatti local	7.05 (2.75) <sup>cdef</sup>	146.88 (12.14)	222.88 (14.95)	171.25 (13.11)	174.80 (13.24)	534.50 (23.13)
18	Manapparai local	3.47 (1.99) <sup>b</sup>	165.72 (12.89)	236.31 (15.39)	247.40 (15.74)	206.84 (14.40)	684.00 (26.16)
19	Madurai local	7.38 (2.81) <sup>ef</sup>	147.38 (12.16)	221.48 (14.90)	180.52 (13.45)	185.28 (13.63)	584.78 (24.19)
20	Mahy-91	15.52 (4.00) <sup>j</sup>	106.98 (10.37)	140.05 (11.86)	149.36 (12.24)	159.90 (12.67)	346.00 (18.61)
21	MDU-1	15.82 (4.04) <sup>jk</sup>	114.63 (10.73)	143.69 (12.01)	139.75 (11.84)	145.30 (12.07)	392.82 (19.83)
22	Musiri local-1	7.08 (2.75) <sup>cdef</sup>	150.38 (12.28)	222.60 (14.94)	198.71 (14.11)	172.62 (13.16)	543.17 (23.32)
23	Musiri local-2	7.15 (2.77) <sup>cdef</sup>	147.88 (12.18)	219.08 (14.82)	198.02 (14.09)	187.87 (13.72)	566.92 (23.82)
24	Musiri local-3	7.33 (2.8) <sup>def</sup>	152.07 (12.35)	217.95 (14.78)	178.71 (13.39)	189.90 (13.80)	556.42 (23.60)
25	Namakkal local	3.20 (1.92) <sup>b</sup>	200.18 (14.17)	271.59 (16.50)	223.15 (14.95)	198.26 (14.10)	719.15 (26.83)
26	Palur-2	11.65 (3.49) <sup>g</sup>	134.90 (11.64)	195.15 (13.99)	154.31 (12.44)	173.66 (13.20)	449.92 (21.22)
27	Pusa purple long	11.48 (3.46) <sup>g</sup>	138.25 (11.78)	169.55 (13.04)	153.75 (12.42)	166.95 (12.94)	450.92 (21.25)
28	Swetha	7.72 (2.87) <sup>f</sup>	150.49 (12.29)	218.86 (14.81)	186.30 (13.67)	188.40 (13.74)	540.83 (23.27)
29	Sungro (No. 132)	18.10 (4.31) <sup>m</sup>	129.17 (11.39)	214.43 (14.66)	193.79 (13.94)	175.96 (13.28)	317.25 (17.83)
30	Simran	15.12 (3.95) <sup>ij</sup>	131.20 (11.480)	151.04 (12.31)	151.61 (12.33)	122.40 (11.09)	395.83 (19.91)
31	Surya	7.47 (2.82) <sup>ef</sup>	159.71 (12.66)	203.58 (14.29)	184.02 (13.58)	172.33 (13.15)	546.15 (23.38)
32	Telikecherla local	16.00 (4.06) <sup>jk</sup>	112.93 (10.65)	154.68 (12.46)	150.08 (12.27)	160.21 (12.68)	361.23 (19.02)
33	Tiruppur local	20.52 (4.58) <sup>n</sup>	119.60 (10.96)	120.38 (10.99)	112.79 (10.64)	138.19 (11.78)	276.82 (16.65)
34	Tuni local	6.45 (2.64) <sup>c</sup>	157.38 (12.56)	219.90 (14.85)	185.96 (13.65)	188.97 (13.76)	591.58 (24.33)
35	UGIE- 4411	12.78 (3.64) <sup>h</sup>	145.21 (12.07)	200.56 (14.18)	156.35 (12.52)	167.38 (12.96)	471.83 (21.73)
36	Ujala	7.37 (2.81) <sup>def</sup>	149.53 (12.25)	222.65 (14.94)	193.73 (13.94)	181.70 (13.50)	553.60 (23.54)
37	Vijay (ARBH-905)	16.97 (4.18) <sup>klm</sup>	128.25 (11.35)	157.28 (12.56)	151.16 (12.32)	163.93 (12.82)	376.83 (19.43)
38	VNR Kanchi	11.37 (3.45) <sup>g</sup>	135.97 (11.68)	186.50 (13.67)	152.90 (12.39)	160.56 (12.69)	474.83 (21.80)
39	VNR Kirti (ARBH-555)	7.03 (2.74) <sup>cdef</sup>	157.63 (12.57)	211.73 (14.57)	207.31 (14.42)	179.32 (13.41)	571.82 (23.92)
40	VNR Utkal	6.92 (2.72) <sup>cdef</sup>	152.81 (12.38)	216.50 (14.73)	204.85 (14.33)	172.03 (13.14)	551.50 (23.49)
SEd		0.0777	0.5919	0.5933	0.5123	0.5398	0.3505
CD (p=0.05)		0.1570	1.1964	1.1991	1.0355	1.0910	0.7084

\* Each value mean of two replications; Figures in parentheses square root transformed values

number of trichomes/ half cm<sup>2</sup> was counted under a stereozoom microscope (Carl Zeiss Stemi 508) at 10x magnification. The trichome length was also measured by using the same leaf bit used for trichome density assessment (Laichattiwar et al., 2018). The data from pot culture and laboratory experiments were subjected to ANOVA using AGRESS software, and significance evaluated by F-tests, while the significance of difference between the treatment mean values was compared by LSD (p=0.05). Correlation and regression coefficients were computed to find out the relationship between the mite incidence and trichome density and length, using SPSS ver.17.0 software.

## RESULTS AND DISCUSSION

The trichome density on leaves revealed highly significant differences among the brinjal entries screened, maximum being in the leaves of Namakkal local (719.15/ 0.5 cm<sup>2</sup>) while the minimum was with the Tiruppur local (276.82/ 0.5 cm<sup>2</sup>) (Table 1). Ayyanar (2017) also observed maximum trichome density on resistant entry IC 249358 (652/ cm<sup>2</sup>) and the least (236/ cm<sup>2</sup>) with IC 261801 which is a highly susceptible one. Jayanthi et al. (2018) also observed similar variations in density of trichomes in brinjal varieties on both adaxial (76.66± 1.90) and abaxial surfaces (121.58± 2.02), exhibiting a positive correlation between trichomes on adaxial and abaxial surfaces. Nain et al. (2017) with seven genotypes of okra observed similar effects of trichomes in okra. Exceptionally, Arka Nidhi which was identified as a resistant entry (2.07/ cm<sup>2</sup> leaf area) recorded low trichome density of (427.50/ 0.5 cm<sup>2</sup> leaf area). Sarma (2010) observed Arka Nidhi with the least mite incidence (8.15 mites/ 6.25 cm<sup>2</sup>) among 12 brinjal entries screened against *T. macfarlanei*. The correlation coefficients (r) between total trichome density and *T. urticae* incidence revealed that the number of trichomes/ 0.5 cm<sup>2</sup> leaf area exhibits a significant negative correlation (r = -0.9195). These observations agree with those of Sarma (2010), Mutthuraju (2013), Mahendrakumar (2016), Ayyanar (2017) who observed that trichome density exhibited a significant negative correlation with mite incidence in brinjal.

The data on trichome length revealed highly significant differences among the brinjal entries, with maximum being observed on the upper surface of Namakkal local (200.18 µm), lower surface of Chinthapalli local-2 (269.36 µm), midrib of Manapparai local (247.40 µm), and veins of Manapparai local (206.84 µm). The least trichome length was observed

with Guntur local-1 (106.52 µm) on upper surface, Tiruppur local (120.38 µm) on lower surface, Tiruppur local (112.79 µm) on midrib, and Simran (122.40 µm) on vein. Ayyanar (2017) observed that the incidence decreased with increase in length of trichomes, and trichomes in the lower surface of leaves were longer in brinjal. Star shaped (multi-radiate, stellate and non-glandular) trichome having one vertical hair and 7-8 horizontal hairs were observed in all the entries. Bayoumy et al. (2017) also reported that brinjal leaves had smooth and soft surfaces with stellate trichomes on both adaxial and abaxial surfaces of leaves. Jayabal et al. (2017) also observed similar trichomes in okra, with longer ones being observed in highly resistant and resistant entries. The correlation coefficients (r) between trichome length and *T. urticae* incidence revealed that the length on the upper and lower surfaces, those on midrib and veins exhibit a significant negative relationship (r = -0.905, -0.901, -0.862, -0.861, respectively). These observations are in conformity with those of Jayabal et al. (2017) and Ayyanar (2017). The multiple linear regression between *T. urticae* incidence and trichome length revealed a significantly high value (R<sup>2</sup> = 0.87), implying that these trichome length contributed directly towards the population buildup of *T. urticae* on brinjal entries to an extent of 87.65%. Thus, it is concluded that host plant resistance (antixenosis) observed with brinjal's morphological characters like trichome density and length exhibit a significant negative impact on the incidence of *T. urticae*.

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