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Field screening of turmeric (*Curcuma longa* L.) genotypes for thrips and shoot borer

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Abstract

Investigations were carried out at college of Horticulture, Bengaluru during *Kharif* seasons of 2018 and 2019 involving 63 turmeric genotypes collected across Karnataka along with three check varieties (Prabha, Prathibha and Salem) planted in Augmented Block Design. Thrips and shoot borer observations gathered were analyzed using factorial design. There is no significant differences were observed among the genotypes for both insect pests indicating uniform pest incidence during two year of study. Among 63 genotypes screened for thrips revealed that, three genotypes (TC-24, TC-29 and TC-40) registered no damage during both the years of study. While the highest damage of 36.25 per cent in TC-37 was *on par* with TC-1, TC-42, TC-13, TC-20, TC-27, TC-38, TC-44, TC-49, TC-55, TC-58 and TC-43 (27.50, 27.50, 31.25, 32.50, 31.25, 32.00, 32.50, 31.75, 28.75, 35.00, 34.50 and 34.25 %, respectively). As many as 20 genotypes have not registered damage by shoot borer during both the years of study (TC-1, TC-2, TC-3, TC-15, TC-16, TC-19, TC-20, TC-21, TC-27, TC-28, TC-30, TC-33, TC-34, TC-39, TC-49, TC-50, TC-51, TC-56, TC-59 and TC-60). The highest damage (45.00 %) was recorded in TC-23 which was *on par* with TC-11 (38.75 %) followed by TC-42 (36.95 %) and TC-45 (35.48 %). From these screening studies with 63 genotypes, three genotypes were appeared to be least damaged by thrips and 27 by shoot borer. There is need to reconfirm the pest reaction under artificial condition to confirm their resistance level against target pests before exploring them in crop improvement programmes.

Keywords: turmeric, genotypes, karnataka, thrips and shoot borer

Introduction

Turmeric (*Curcuma longa* L.) is an important sacred and ancient spice of India popularly known as Indian saffron. In India, turmeric is being cultivated in an area of 2,96,181 hectare with an annual production of 11,78,750 tonnes (dry) ^[1] and exporting 1,37,650 tonnes with earning a foreign exchange of Rs. 1,28,691 lakhs ^[2] and accounting for nearly 70 per cent of the world production of turmeric. In India it is widely used in religious functions and ceremonies besides its use as food spice. In India, turmeric is mainly grown in Telangana (18.71 %), Maharashtra (18.31 %), Andhra Pradesh (10.03 %), Orissa (9.40 %), Karnataka (7.00 %), Tamil Nadu (6.22 %), West Bengal (6.01 %) and almost all states in open as well as in partial shade conditions ^[3]. In Karnataka, it is largely cultivated in Chamarajanagar (8,378 ha), Belagavi (5,018 ha), Bagalkot (3,097 ha), Mysore (2,527 ha), Mandya (232 ha), Bidar (339 ha), Kalburgi (1,041 ha) and Chikkamagalore (184 ha) districts in an area of 24,912 hectare with a production of 2, 50, 829 metric tonnes of fresh turmeric ^[4]. A roving survey in Belagavi district of Karnataka, India during 1996 has documented as many as 63 pests invading turmeric of which only seven species with more than 10 per cent damage were listed as major ^[8]. Efforts to screen the reaction of turmeric germplasm for insect pests are very little or scarce barring a few scattered studies ^[9, 12, 13]. Hence, in this background the present effort is to report the reaction documented with thrips and shoot borer or shoot borer, which were almost uniform in the experimental area and period. Under ICAR Emeritus Scientist project as many as 63 genotypes of turmeric were collected from southern districts of Karnataka to ascertain the genetic relatedness with commercial or released varieties through DNA fingerprinting. At same time they were screened for insect pests at college of Horticulture, Bengaluru from 2018-2019 and 2019-20 *Kharif* seasons.

Materials and methods

Investigations were carried out at College of Horticulture, Bengaluru located at 930 meter above mean sea level at 13° 05' North latitude and 77° 33' East longitude in the Eastern dry

zone (Zone-5) of Karnataka during 2018 and 2019 *Kharif* seasons. Experimental material comprised of 63 genotypes collected from farmers' fields of potential turmeric growing areas spread over Chamarajanagar, Mysore, Mandya and Shivamogga along with three check varieties *i.e.*, Prabha, Prathibha and Salem obtained from UHS(S)/UAHS/ Horticulture Farm Yallapura (Table 1). Lines sowing

following Augmented Block Design with the (treated-mancozeb-0.3 % and Quinolphos 0.2 %) ^[5] rhizomes of 63 genotypes were sown on 15th May of 2018 and 2019 at a spacing of 30 x 30 cm. All the agronomic package of practices was adapted to grow a healthy crop except for plant protection ^[5].

Table 1: Genotypes collected from major turmeric growing districts of southern Karnataka

District	Taluk	Villages	No. Samples	No. of genotypes
Chamarajanagar	Chamarajanagar	Thamadahalli	6	20
		Udigala	3	
		K K Undi	1	
		Shivapura Yelle	1	
		Chandikote	1	
		Karinanjupura	2	
		Haradanahalli	2	
		Ramasamudra	1	
		Somavarpet	1	
		COHB, Haradanahalli	2	
	Gundlupet	Lakkur	2	14
		Angala	1	
		Raghavapura	2	
		Terkanambi	2	
		Vijayapura	3	
		Begur	1	
		Hebbur	1	
		Malahalli	1	
	Patterahalli	1		
Mysuru	Nanjanagud	Devanur	2	12
		Chikka Kowlande	1	
		Dodda Kowlande	4	
		Konanur	2	
		Konapurada Yelle	2	
		ChunchanaHalli Yalle	1	
Mandya	Malavalli	Doddaboovalli	2	8
		Mallinathapura	4	
		Purigali	2	
Shimoga	Shikaripura	Kotta	2	9
		Nimbegondi	2	
		Issur	1	
		Gama	1	
		Haragoppa	1	
		Haragoppa Thanda	1	
	Thirthahalli	Uthalli	1	
Total			63	
Known varieties from SAUs		COH(Sirsi)	Prabha	1
		UAHS, KVK	Prathibha	1
		Horticultural Farm, Yellapura	Salem	1

Scoring for thrips and shoot borer

Incidence of shoot borer and thrips was recorded under natural pest infestation with need-based insecticide application (Anon., UHSB, 2017) to prevent pest outbreak and crop loss. The number of plants infested by both shoot borer and thrips was recorded by observing all the plants in a

genotype and documenting the infestations.

Incidence of thrips and shoot borer damage was scored per cent pest incidence by dividing number infested plants with total number of observed plants at 90, 120, 150 and 180 DAP. The resultant data was processed in Microsoft Excel and subjected to factorial analysis using WASP software ^[7].

Results and discussion

Thrips

Among the different genotypes screened for thrips, three genotypes (TC-24, TC-29 and TC-40) have registered no damage by during both the years of study as revealed by pooled analysis (Table 2 and Plate 1). Hence, these genotypes were grouped under tolerant types. The genotypes (TC-5, TC-47, TC-48, TC-6 and TC-51) were recorded least damage to thrips. Hence, these genotypes were grouped under moderately tolerant to thrips infestation. While, the highest damage registered in genotypes (TC-1, 4, 11, 13, 14, 20, 27, 37, 38, 39, 41, 42, 43, 44, 46, 49, 55, 58 and TC-59 respectively) were grouped under susceptible to thrips infestation. The degree of variation occurred with respect to the response of genotypes to thrips damage was expected since, any tolerant or susceptibility of the genotype to the pest is controlled by the genetic constitution of genotype. Hossain [6] found that, GCO34 recording less than 8.29 thrips per plant in garlic was highly resistant, whereas Genotypes GC0013, GC0028 and GC0030 recorded higher thrips population of more than 13.41 thrips per plant and lower bulb yield (4.07, 4.52) were grouped into highly susceptible. Similarly Shah and Khan [11] reported out of eight genotypes of onion, Trichmer was highly susceptible and whereas Swat-1 as tolerant was found.

Shoot borer

Among different turmeric genotypes (TC-1, TC-2, TC-3, TC-

15, TC-16, TC-19, TC-20, TC-21, TC-27, TC-28, TC-30, TC-33, TC-34, TC-39, TC-49, TC-50, TC-51, TC-56, TC-59 and TC-60) 20 genotypes have registered no damage by shoot borer during both the years of study as revealed by pooled analysis (Table 3 and Plate 2). Hence, these genotypes were grouped as tolerant types as compared to other genotypes. The genotypes (TC-13, 57, 24, 46 and TC-26) were recorded least damage (20.00, 20.00, 21.25 15.00 and 11.25 %) to shoot borer (*Conogethus punctiferalis*). Hence, these genotypes were grouped under moderately tolerant to shoot borer infestation. While the highest damage (10 to 45 %) registered in genotypes (TC-4, 5, 7, 22, 29, 36, 38, 41, 44, 45, 53, 55, 59, 61 and Salem) were susceptible type. The degree of variation occurred with respect to the response of genotypes to shoot borer was expected since, any tolerant or susceptibility of the genotype to the insect pest is controlled by the genetic constitution of genotype. Similar results find with Ravi *et al.* [10]. Kotikal and Kulakarni [9] reported that, among the different genotypes BSR-1, CO-1, Cuddaph and Salem emerged as tolerant against *Conogethus punctiferalis*. Singh *et al.* [12] reported that, 11 genotype were rated as moderately resistant, three as moderately susceptible, five as susceptible and only one highly susceptible against the shoot borer. Singh *et al.* [12] reported that, 11 genotype were rated as moderately resistant, three as moderately susceptible, five as susceptible and only one highly susceptible against the shoot borer.

Table 2: Per cent thrips incidence recorded in different turmeric genotypes

No. Genotypes	2018-19	2019-20	Mean
TC-1	27.50 (30.79)	32.50 (34.44)	30.00 (32.61)
TC-2	23.75 (29.07)	33.75 (35.27)	28.75 (32.17)
TC-3	11.26 (17.19)	11.26 (17.18)	11.26 (17.19)
TC-4	27.5 (31.52)	26.25 (30.44)	26.88 (30.98)
TC-5	2.52 (5.35)	2.52 (5.35)	2.52 (5.35)
TC-6	0.0 (0.99)	7.52 (11.74)	3.77 (6.37)
TC-7	21.25 (27.04)	18.75 (25.38)	20.00 (26.21)
TC-8	15.01 (19.79)	21.25 (27.04)	18.13 (23.42)
TC-9	13.76 (18.99)	12.51 (18.05)	13.13 (18.52)
TC-10	15.01 (19.79)	11.26 (17.19)	13.13 (18.49)
TC-11	21.25 (26.74)	30.00 (33.00)	25.63 (29.87)
TC-12	25.50 (29.81)	13.76 (18.99)	19.63 (24.4)
TC-13	31.25 (33.24)	21.25 (27.04)	26.25 (30.14)
TC-14	24.75 (29.49)	31.25 (33.81)	28.00 (31.65)
TC-15	25.00 (29.35)	25.00 (29.79)	25.00 (29.57)
TC-16	17.50 (24.44)	8.77 (12.60)	13.13 (18.52)
TC-17	13.76 (18.99)	11.26 (17.19)	12.51 (18.09)
TC-18	23.75 (28.61)	17.50 (24.52)	20.63 (26.57)
TC-19	25.00 (29.35)	23.75 (28.7)	24.38 (29.03)
TC-20	32.50 (34.33)	20.00 (26.1)	26.25 (30.21)
TC-21	15.01 (19.79)	17.50 (24.44)	16.25 (22.12)
TC-22	0.0 (0.99)	11.27 (14.63)	5.65 (7.81)
TC-23	15.01 (19.79)	0.0 (0.99)	7.52 (10.39)
TC-24	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-25	11.26 (17.19)	21.25 (27.04)	16.25 (22.12)
TC-26	25.50 (29.81)	20 (26.24)	22.75 (28.02)
TC-27	32.00 (33.91)	23.75 (28.7)	27.88 (31.31)
TC-28	23.25 (28.11)	21.25 (27.33)	22.25 (27.72)
TC-29	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-30	22.80 (28.12)	17.50 (24.52)	20.15 (26.32)
TC-31	0.0 (0.99)	15.01 (20.08)	7.52 (10.54)
TC-32	0.0 (0.99)	11.26 (17.19)	5.64 (9.09)
TC-33	15.01 (20.08)	13.76 (18.99)	14.38 (19.53)
TC-34	20.01 (23.45)	18.76 (22.68)	19.38 (23.07)
TC-35	25.00 (29.35)	15.01 (20.08)	20.00 (24.71)

TC-36	25.50 (29.7)	18.75 (25.61)	22.13 (27.66)
TC-37	36.25 (36.49)	35.00 (35.9)	35.63 (36.19)
TC-38	32.50 (34.45)	26.25 (30.07)	29.38 (32.26)
TC-39	27.00 (30.60)	31.25 (33.81)	29.13 (32.20)
TC-40	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-41	23.75 (28.61)	32.50 (34.33)	28.13 (31.47)
TC-42	22.50 (27.84)	18.76 (22.68)	20.63 (25.26)
TC-43	34.25 (35.43)	25.00 (29.47)	29.63 (32.45)
TC-44	31.75 (33.91)	27.50 (31.38)	29.63 (32.65)
TC-45	22.50 (27.84)	18.76 (22.68)	20.63 (25.26)
TC-46	5.02 (9.71)	30.00 (33.04)	17.51 (21.38)
TC-47	2.52 (5.35)	2.52 (5.35)	2.52 (5.35)
TC-48	2.52 (5.35)	2.50 (4.61)	2.51 (4.98)
TC-49	28.75 (32.24)	25.00 (29.7)	26.88 (30.97)
TC-50	6.27 (10.80)	7.52 (11.74)	6.89 (11.27)
TC-51	7.52 (11.74)	7.52 (11.74)	7.52 (11.74)
TC-52	23.75 (28.61)	18.75 (25.38)	21.25 (27)
TC-53	25.00 (29.35)	26.25 (30.27)	25.63 (29.81)
TC-54	20.00 (26.18)	23.75 (28.70)	21.88 (27.44)
TC-55	35.00 (35.99)	27.50 (30.79)	31.25 (33.39)
TC-56	7.52 (11.74)	0.0 (0.99)	3.77 (6.37)
TC-57	7.52 (11.74)	0.0 (0.99)	3.77 (6.37)
TC-58	34.50 (35.62)	28.75 (31.93)	31.63 (33.77)
TC-59	22.50 (27.84)	25.00 (29.70)	23.75 (28.77)
TC-60	26.25 (30.59)	17.50 (24.15)	21.88 (27.37)
TC-60-1	23.75 (28.61)	25.00 (29.35)	24.38 (28.98)
TC-60-2	26.50 (30.63)	15.01 (19.79)	20.75 (25.21)
TC-61	23.00 (28.27)	23.25 (28.29)	23.13 (28.28)
Prabha	23.75 (28.61)	18.75 (25.38)	21.25 (27.00)
Salem	25.00 (29.35)	26.25 (30.27)	25.63 (29.81)
Prathibha	20.00 (26.18)	23.75 (28.70)	21.88 (27.44)
Mean	18.84 (22.63)	17.88 (22.10)	
	Genotypes	Year	Interaction
CD@ 5%	5.55	0.97	7.86
SE(m)	20	0.36	2.82

Table 3: Per cent shoot borer incidence recorded in different turmeric genotypes

No. Genotypes	2018-19	2019-20	Mean
TC-1	0.0 (0.99)	0.0(0.99)	0.0 (0.99)
TC-2	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-3	0.0 (0.99)	0.0(0.99)	0.0(0.99)
TC-4	0.0 (0.99)	0.0 (0.99)	29.37 (32.32)
TC-5	0.0 (0.99)	0.0(0.99)	27.50 (31.39)
TC-6	0.0 (0.99)	0.0 (0.99)	21.25 (26.90)
TC-7	33.75 (35.28)	32.50 (33.96)	23.12 (28.16)
TC-8	25.00 (29.36)	25.00 (29.36)	0.0 (0.99)
TC-9	27.50 (31.39)	0.0 (0.99)	0.0(0.99)
TC-10	27.50 (31.39)	0.0 (0.99)	0.0 (0.99)
TC-11	17.50 (24.44)	38.75 (37.63)	0.0 (0.99)
TC-12	25.00(29.36)	22.50 (27.81)	0.0 (0.99)
TC-13	20.00 (26.19)	0.0 (0.99)	0.0 (0.99)
TC-14	26.50 (30.12)	0.0 (0.99)	0.0 (0.99)
TC-15	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-16	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-17	0.0 (0.99)	30 (33.05)	0.0 (0.99)
TC-18	0.0 (0.99)	31.25 (33.82)	0.0 (0.99)
TC-19	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-20	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-21	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-22	0.0 (0.99)	0.0 (0.99)	26.25 (30.33)
TC-23	0.0 (0.99)	45.00 (41.96)	23.75 (28.23)

TC-24	0.0 (0.99)	21.25 (27.05)	29.37 (32.31)
TC-25	0.0 (0.99)	28.75 (31.78)	0.0 (0.99)
TC-26	0.0 (0.99)	11.25 (19.52)	0.0 (0.99)
TC-27	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-28	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-29	0.0 (0.99)	0.0 (0.99)	27.50 (31.09)
TC-30	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-31	0.0 (0.99)	0.0 (0.99)	13.14 (15.53)
TC-32	0.0 (0.99)	0.0 (0.99)	14.39 (16.62)
TC-33	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-34	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-35	0.0 (0.99)	0.0 (0.99)	16.26 (17.48)
TC-36	0.0 (0.99)	0.0 (0.99)	12.51 (15.17)
TC-37	0.0 (0.99)	0.0 (0.99)	19.39 (19.31)
TC-38	0.0 (0.99)	0.0 (0.99)	11.26 (14.40)
TC-39	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-40	0.0 (0.99)	0.0 (0.99)	15.01 (17.02)
TC-41	0.0 (0.99)	27.50 (31.022)	15.64 (17.40)
TC-42	0.0 (0.99)	36.25 (36.946)	0.0 (0.99)
TC-43	28.75 (31.59)	0.0 (0.99)	22.50 (21.48)
TC-44	23.75 (29.08)	0.0 (0.99)	25.00 (29.42)
TC-45	32.50 (33.97)	35.00 (35.47)	5.64 (10.25)
TC-46	15.00 (22.50)	0.0 (0.99)	0.0 (0.99)
TC-47	23.75 (28.62)	0.0 (0.99)	0.0 (0.99)
TC-48	35.00 (36.00)	0.0 (0.99)	0.0 (0.99)
TC-49	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-50	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-51	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-52	0.0 (0.99)	0.0 (0.99)	13.76 (16.00)
TC-53	0.0 (0.99)	0.0 (0.99)	18.14 (18.96)
TC-54	0.0 (0.99)	0.0 (0.99)	17.51 (18.23)
TC-55	0.0 (0.99)	0.0 (0.99)	10.64 (14.02)
TC-56	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-57	20.00 (26.19)	0.0 (0.99)	0.0 (0.99)
TC-58	35.00 (36.00)	0.0 (0.99)	15.64 (17.12)
TC-59	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-60	0.0 (0.99)	0.0 (0.99)	0.0 (0.99)
TC-60-1	26.25 (30.08)	0.0 (0.99)	0.0 (0.99)
TC-60-2	0.0 (0.99)	26.25 (30.08)	0.0 (0.99)
Prabha	25.00 (29.31)	22.50 (27.81)	0.0 (0.99)
Salem	20.00 (26.19)	0.0 (0.99)	0.0 (0.99)
Prathibha	26.50 (30.12)	0.0 (0.99)	0.0 (0.99)
TC-61	28.75 (32.25)	27.50 (31.3)	26.87 (30.69)
Mean	7.719 (9.67)	8.097 (9.507)	
	Genotypes	Year	Interaction
CD@5%	5.62	1.00	7.95
SE(m)	3.77	0.67	5.33



Plate 1: Thrips damage in turmeric genotypes



Plate 2: Shoot borer damage in turmeric genotypes

Conclusion

- For thrips infestation, among 63 genotypes, three genotypes (TC-24, TC-29 and TC-40) found to be tolerant types. Five genotypes (TC-5, TC-47, TC-48, TC-6 and TC-51) were grouped as moderately tolerant to thrips. While, 19 genotypes were highest damage (2.50 to 36.25 %) and grouped under susceptible to thrips infestation.
- Among different turmeric genotypes 27 genotypes have registered no damage by shoot borer and grouped as tolerant types. Five genotypes (TC-13, TC-57, TC-26, TC-24 and TC-46) were grouped under moderately tolerant to shoot borer infestation. While, 16 genotypes were the highest damage (10 to 45 %) and grouped into susceptible type.

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