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RESEARCH PAPER

Evaluation of tomato hybrids for resistance to root knot nematode (*Meloidogyne incognita*)

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Abstract : Three new tomato (*Solanum lycopesicum* L.) hybrids were evaluated for their reaction to the root knot nematode, *Meloidogyne incognita*,in comparison with their parents and resistant and susceptible check cultivar/hybrid in three different geographical locations in Tamil Nadu, India. The biochemical traits of the tested cultivars and hybrids were also compared. The resistant parent HN2 showed less root knot nematode females per gram of roots, number of eggmasses per gram of roots and root knot index. The newly synthesized tomato hybrid HN2 × CLN 2123A registered the least number of root knot nematode females per gram of roots, number of eggmasses per gram of roots and root knot index. The reaction to the nematode of the hybrid was at par with the resistant check Hisar Lalit. Also, the hybrids registered the greatest fruit yield per plant, plant height, number of branches per plant, number of fruits per plant and root length. The biochemical traits phenol content and root ascorbic acid content and the enzymes peroxidase, IAA oxidase and acid phosphatase activity were greatest in the hybrid HN2 × CLN 2123A. These biochemical traits excelled both parents, which would indicate the role of over dominant genes.

Key Words : *Solanum lycopersicum*, Evaluation-root-knot nematode, Resistance

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INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is severely affected by root knot nematodes. The incidence of root knot nematode is high in areas where tomato is cultivated intensively. According to Trudgill and Block (2001), *Meloidogyne incognita* (Kofoid *et* White) Citw. is one of the most important apomictic species of root-knot nematodes in many temperate and tropical countries. It is the worlds most crop damaging crop nematode and causes about 100 billion Euro losses in crop plants annually (Sasser *et al*., 1987). To manage root-knot nematodes, various control measures have been suggested by several workers (Sikora and Grew, 1993). However, the withdrawal of many nematicides, including soil fumigants, which are expensive, labour intensive and associated with ecological hazards limits this option of control measures and emphasizes the need for alternative strategies to control the nematode infestation (Sethi and Gaur, 1986).The development of resistant/tolerant cultivars is commercially successful for the control of the most damaging species of *Meloidogyne* spp. on tomato. Although resistance to root knot nematodes is

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available in several crop plat species,degeneration of these crop species/cultivars were resulted due to changes in the genetic makeup and the effect of environmental factors particularly increased levels of temperature. However, the response of resistant varieties to high temperature in breaking the resistance was not the same (De Araujo, 1980).When plants are affected by pathogen, wounding elicitors, hormones and internal biochemical components would be triggered which results inthe synthesis of differential levels of biochemicals in the plants (Van Loon, 1985). Hence, understanding the biochemical basis of resistance to disease incidence would help the breeder to select breeding lines that confirm tolerance/resistance to the target pathogen. The isozyme variation of genotypes is proved to be a powerful tool to complement conventional biometric studies. Expressions of differences between the genotypic levels could be well studied by isozyme variations (Sindhu *et al*., 1984). Hence, the present study has been formulated to evaluate tomato F_1 hybrids against root knot nematode resistance coupled with high yield.

MATERIAL AND METHODS

Field experiments:

The investigation was carried out in three different geographical locations *viz*., Rayakotttai of Dharmapuri district (E1), Oddanchatram of Dindigul district (E2) and Attur of Salem district (E3) in Tamil Nadu which are claimed as hot spot area for root knot nematode infestation.The experimental materials consisted of nine genotypes including three new F_1 hybrids *viz*., CLN 2123A × HN2, HN2 × CLN 2123A and LCR2 × CLN 2123A, their parents CLN 2123A, HN2 and LCR2, the resistant check cultivar Hisar Lalit, the susceptible check hybrid Lakshmi and the susceptible check cultivar Co3. Seeds of all the test plants were sown in protrays filled with cocopeat as germinating medium. Twenty five days old healthy seedlings were transplanted in the main field at a spacing of 60 cm × 60 cm during the summer season (February to June 2006-2007). The experiments were laid out in a Randomized Block Design and replicated thrice. Recommended cultural operations were followed. At mostcare was taken to avoid application of any nematicides in the soil throughout the study. Biometrical observations *viz*., plant height (cm), number of branches per plant, number of fruits per plant, root length (cm), yield per plant (g) and nematode incidence traits *viz*., number of root knot nematode females per gram of roots, number of egg masses per gram of roots and root knot index and biochemical constituents and enzymes *viz*., total phenol content in roots (Bray and Thorpe, 1954), ascorbic acid content in roots (AOAC, 1975), peroxidase activity (Srivastava, 1987), IAA oxidase activity (Gordon and Weber, 1951), acid phosphatase activity (Ferreira *et al*., 1998) were also analyzed. All data were subjected to statistical analysis as suggested by Panse and Sukhatme (1957).

RESULTS AND DISCUSSION

Root knot index of tomato genotypes ranged from 2.1 to 3.8 (Table 4). Among the three hybrids evaluated, HN2 × CLN 2123A exhibited the least value of 2.1. Among the parents, HN2 registered the lowest mean value of 1.8 which is at par with the nematode resistant check Hisar Lalit (1.9). The other parents CLN 2123A (4.7) and LCR2 (4.9), the susceptible hybrid Lakshmi (5.0) and the susceptible cultivar Co 3 (5.0) registered root-knot indices higher than the hybrids. Mean values of root knot index over different locations revealed that the test hybrid HN2 × CLN 2123A (2.0 in Rayakottai and Oddanchatram and 2.3 in Attur), the parent HN2 (1.7 in Rayakottai and Oddanchatram and 2.0 in Attur) and the resistant check Hisar Lalit (2.0 in Rayakottai, 1.7 in Oddanchatram and 2.0 in Attur) registered root knot index values lower than the other genotypes (Table 5). The nematode tolerance of HN2 × CLN 2123A, as indicated by the low values of root knot indices, revealed that the tolerance would have been acquired from the tolerant female parent HN2. Hisar Lalit is a released cultivar of Hisar Agricultural University, Hisar, India, having tolerance to nematode infestation. Whereas, the other hybrid CLN 2123A × HN2, followed by the parents CLN 2123A and LCR2, the check hybrid Lakshmi and the check cultivar Co3 could be categorized as susceptible to highly susceptible genotypes as evidenced by their root knot index values. These results were also confirmed by the greater root length of the test hybrid HN2 × CLN 2123A, the parent HN2 and the resistant check cultivar Hisar Lalit. The pooled mean values of root length varied from 45.4 cm to 24.1 cm. The test hybrid HN2 × CLN 2123A registered the largest root length value of 45.4 cm. It was followed by the parent HN2 (42.5 cm) and resistant check Hisar Lalit (40.5 cm). The *per se* values of the three locations revealed that the cross HN2 × CLN 2123A registered root length values (47.6) cm in Rayakottai, 44.8 cm in Oddanchatram and 43.8 cm in Attur) larger than the other hybrids (CLN 2123A × HN2 and LCR2 × CLN 2123A). It was followed by the parent HN2 (42.5cm in Rayakottai, 44.2 cm in Oddanchatram and 40.9 cm in Attur) and resistant check HisarLalit (40.8 cm in Rayakottai, 40.7 cm in Oddanchatram and 40.0 cm in Attur). The longer roots of this cross indicated the tolerance nature of the hybrid against the root knot nematode infestation and might be due to the involvement of the tolerant parent, *i.e.* HN2 in this cross. The cross is a product of high × low mean values (of root knot index) indicating that additive × dominant nature of gene action plays a major role for nematode infestation. Similar results were also reported by Sriharsha (2004).

For other nematode variables *viz*., number of root knot nematode females per gram of roots and number of egg masses per gram of roots (Table 3), the parent HN2 (5.2 and 4.7), resistant check HisarLalit (8.3 and 4.9) and the cross HN2 × CLN 2123A (9.4 and 7.0) registered lower pooled mean values than the other genotypes (Table 3). The results of different locations also showed similar trend. The parent HN2 (4.7 and 4.7 inRayakottai, 2.7 and 4.7 in Odddanchatram and 8.3 and 4.6 inAttur) registered the lowest mean values for number of root knot nematode females per gram of roots and number of egg masses per gram of roots, respectively. It was followed by HisarLalit (9.3 and 5.0 in Rayakottai, 9.3 and 5.0 in Odddanchatram and 9.7 and 11.1 inAttur) and HN2 × CLN 2123A (8.7 and 4.7 in Rayakottai, 7.3 and 4.7 in Odddanchatram and 9.0 and 5.3 inAttur). Minimal number of egg masses on resistant cultivars was also reported by Jain *et al*. (1990). The test hybrid HN2 × CLN 2123A expressed resistance/tolerance to root knot nematode might be due to the involvement of the resistant parent HN2. Further, it is a product of low × high *per se* values of this trait indicating dominant × additive type of gene expression that governs these traits in this cross. Sindhu and Webster (1975) and Bost (1982) reported that one or more dominant alleles control genetic resistance to root knot nematode. It was also observed that when the HN2 was used as a female parent, the hybrid expressed resistance but not *vice versa*, suggesting that the resistance might be due to maternal effect. These results suggests that the parent HN2 could be used as a potential female parent for developing root-knot nematode resistant hybrids of tomato.

Plant height and number of branches per plant are important characters, in which plants expressed their growth and vigour. The results of plant height and number of branches per plant are presented in the Table 1. In all the three locations the synthesized hybrid HN2 × CLN 2123 A, registered the highest plant height and number of branches per plant. The hybrid HN2 × CLN 2123A registered the highest mean values of 96.09 cm and 35.96 as plant height and number branches per plant in pooled mean value. Similarly the same hybrid also registered higher mean values for plant height (127.86 cm, 79.46 cm and 80.96 cm) and number of branches per plant (14.20, 10.6 and 11.26) in all the three locations of the study.

Number of fruits per plant (Table 2.) is an important yield contributing trait. There were no much differences observed among the hybrids and parents over the locations tested. Among the parents CLN 2123A was found to have more number of fruits than other parent HN2. However, the hybrids CLN 2123 A × HN2 and

Table 1: *per se* performance of parents, hybrids and check varieties/hybrids

Varieties	Plant height (cm)			Pooled mean	No. of branches per plant			Pooled mean
	E1	E2	E3		E1	E2	E3	
CLN 2123 A	118.86	69.26	65.35	84.49	8.06	5.66	5.83	6.52
HN2	94.33	54.46	54.16	67.65	6.76	5.23	4.86	5.62
CLN 2123A x HN2	127.30	77.20	76.60	93.70	13.73	10.20	11.46	11.80
HN2 x CLN 2123A	127.86	79.46	80.96	96.09	14.20	10.16	11.26	11.87
LCR2	77.86	52.86	49.83	60.18	6.20	4.76	4.50	5.15
COTH2	122.30	72.43	78.43	91.05	11.23	9.33	8.83	9.80
Hisar Lalit	110.06	69.03	72.20	83.76	12.20	8.13	8.86	9.73
Lakshmi	134.03	76.00	81.36	97.13	12.10	9.00	8.30	9.80
CO_3	72.36	51.53	49.50	57.80	5.93	4.90	4.60	5.14
S.E.±	4.09	3.27	2.96		0.83	0.52	0.3	
C.D. (P=0.05)	8.07	6.94	6.28		0.23	1.10	0.70	

E1- Rayakottai E2 – Oddanchatram E3 –Attur

HN2 × CLN 2123 A excelled both the parents with respect to fruit number. This may be due to the presence of over dominant genes, which excelled the better parent CLN 2123A. These results are in line with the findings of Sidhu *et al*. (1984) who reported that the hybrid Gramed × S12 excelled the better parent Gramed by recording more number of fruits. Non-additive genes of complementary nature in parents would also result in better expression of trait in F_1 hybrid. It was also observed that both direct as well as reciprocal crosses excelled private hybrid Lakshmi.

The *per se* values of tomato yield per plant in the pooled mean varied from 773.8 g to 2,255.2 g (Table 2). Among the three crosses tested, HN2 × CLN 2123A registered the greatest fruit yield of 2,255.2 g per plant which was larger than that of both parents and resistant check cv. HISAR LALIT (1,433.5 g) and susceptible check hybrid Lakshmi (2,082.0 g).The greater yield performance of HN2 × CLN 2123A might be due to taller plants and larger numbers of branches per plant and number of fruits per plants observed in this hybrid. Mean values of these traits over different locations also showed a similar trend. The greater fruit yield recorded by the hybrid HN2 × CLN 2123A, under high incidence of root-knot nematode infestation, revealed the resistant/tolerant nature of the hybrid against root-knot nematode. Further, the hybrid exhibited yield per plant larger than that of both the parents thus, indicating the dominant nature of the hybrid.

Biochemical response :

Many plants respond to pathogen infection by

Table 2: *per se* performance of parents, hybrids and check varieties/hybrids

Varieties	No. of fruits per plant			Pooled mean	Yield per plant (kg)			Pooled mean
	E1	E2	E3		E1	E2	E3	
CLN 2123 A	41.88	22.33	29.27	31.16	2141.98	938.33	899.96	1326.76
HN2	22.88	14.33	13.00	16.74	1459.73	854.00	627.44	980.39
CLN 2123A x HN2	49.09	28.00	35.66	37.58	2867.06	1474.00	1717.00	2019.35
HN2 x CLN 2123A	53.07	28.66	35.96	39.23	3296.86	1541.66	1927.20	2255.24
LCR2	19.48	12.33	10.66	14.16	1335.74	813.33	521.82	890.30
COTH2	42.26	25.00	27.03	31.43	2455.05	1386.66	1177.28	1673.00
Hisar Lalit	41.47	18.33	23.52	27.77	2402.88	1106.33	791.27	1433.49
Lakshmi	41.86	24.66	33.66	33.39	2815.52	1493.33	1937.09	2081.98
CO_3	20.18	11.66	10.66	14.17	1177.66	666.33	477.34	773.78
S.E.±	2.23	1.64	1.14		183.89	99.99	51.30	
C.D. (P=0.05)	4.74	3.48	2.43		389.92	212.02	108.78	

E1- Rayakottai E2 – Oddanchatram E3 –Attur

Table 3 : *per se* performance of parents, hybrids and check varieties/hybrids

Varieties	Number of root knot females per g of roots			Pooled mean	No. of eggmass/g. of roots			Pooled mean
	E1	E2	E3		E1	E2	E3	
CLN 2123 A	42.66	44.10	42.28	43.01	26.66	23.66	25.70	25.34
HN2	8.33	4.66	2.66	5.22	4.66	4.66	4.65	4.66
CLN 2123A x HN2	31.33	34.66	27.00	31.00	30.66	36.00	24.11	30.26
HN2 x CLN 2123A	9.66	9.33	9.33	9.44	5.00	5.00	11.10	7.03
LCR2	48.66	43.10	42.00	44.59	29.66	33.33	31.66	31.55
COTH2	40.33	47.00	46.00	44.44	36.86	33.33	36.00	35.40
Hisar Lalit	7.33	9.00	8.66	8.33	4.66	4.66	5.29	4.87
Lakshmi	48.33	42.33	42.00	44.22	38.33	36.66	43.38	39.46
CO_3	48.33	48.33	42.00	46.22	43.33	38.33	51.66	44.44
S.E.±	1.34	1.44	1.57		1.64	2.55	2.26	
C.D. (P=0.05)	2.84	3.05	1.04		3.47	5.41	4.82	

E1- Rayakottai E2 – Oddanchatram E3 - Attur elucidating a hypersensitive reaction (HR) at the site of infection and subsequently develop a systematic resistance response (Keen, 1992). Accumulation of phenolic compounds, as a host parasite reaction, is the general phenomenon of resistance and breakdown of these compounds determine the degree of resistance (Sindhan and Parashar, 1984). Biochemical changes in tomato plants infected by *Meloidogyne incognita* was established by Tayal and Agarwal (1982) and Sharma *et al*. (1990).

Phenol content:

Root phenol content study revealed that the cross HN2 × CLN 2123A registered the highest vales of 0.42 mg/g roots. It was at par with the parent HN2 (0.40 mg/g roots) and resistant check Hisar Lalait (0.42 mg/g roots) (Table 5). Mean values of different location also showed the similar trend. The test hybrid HN2 × CLN 2123A registered the greatest root phenol content of 0.42 mg/g roots at all the three locations. These results suggest that the increased root phenol content of the cross HN2 × CLN2123A might be due to the involvement of the better parent HN2. The fact that the cross excelled both the parents might be due to the operation of over dominant genes for this trait. Larger phenol content in nematode resistant varieties/ hybrids than in susceptible varieties/ hybrids of tomato was also reported by Narayana and Reddy (1980), Gopinatha *et al*. (2002) and Mahajan *et al*. (1985).

Ascorbic acid content:

Similarly, root ascorbic acid content plays a major

Table 4: *per se* performance of parents, hybrids and check varieties/hybrids

Varieties	Root knot index			Pooled mean	Root length (cm)			Pooled mean
	E1	E2	E3		E1	E2	E3	
CLN 2123 A	5.00	4.66	4.58	4.75	25.40	24.66	22.15	24.07
HN2	1.66	1.66	2.00	1.77	42.50	44.20	40.86	42.52
CLN 2123A x HN2	3.66	3.66	4.00	3.77	33.90	35.27	31.46	33.54
HN2 x CLN 2123A	2.00	2.00	2.33	2.11	47.63	44.80	43.83	45.42
LCR2	5.00	4.66	5.00	4.89	31.26	30.20	29.16	30.21
COTH2	5.00	4.33	5.00	4.78	34.70	33.20	31.90	33.27
Hisar Lalit	2.00	1.66	2.00	1.89	40.83	40.66	40.03	40.51
Lakshmi	5.00	4.33	5.00	4.78	38.03	31.73	30.76	33.51
CO_3	5.00	5.00	5.00	5.00	33.16	31.16	31.76	32.03
S.E.±	0.20	0.33	0.18		2.25	1.48	1.38	
C.D. (P=0.05)	0.44	0.70	0.38		4.78	3.14	2.93	

E1- Ravakottai E2 – Oddanchatram E3 - Attur

Table 5: *per se* performance of parents, hybrids and check varieties/hybrids

Varieties	Total phenol content (mg/g of roots)			Pooled mean	Ascorbic acid content (mg/100g root)			Pooled mean
	E1	E2	E3		E1	E2	E3	
CLN 2123 A	0.17	0.16	0.15	0.16	7.13	7.16	6.49	6.93
HN2	0.40	0.41	0.40	0.30	12.40	13.00	12.33	12.58
CLN 2123A x HN2	0.24	0.26	0.24	0.25	8.63	9.33	8.47	8.81
HN2 x CLN 2123A	0.42	0.42	0.42	0.42	13.90	13.73	13.57	13.73
LCR2	0.19	0.20	0.19	0.19	6.50	6.50	6.30	6.43
COTH2	0.24	0.24	0.23	0.24	7.26	7.33	7.10	7.23
HisarLalit	0.40	0.40	0.39	0.40	13.90	13.66	13.27	13.61
Lakshmi	0.22	0.26	0.23	0.24	8.03	8.03	7.87	7.98
CO_3	0.18	0.20	0.18	0.19	6.70	6.33	6.06	6.36
S.E.±	0.01	0.02	0.01		0.30	0.40	0.38	
C.D. (P=0.05)	0.03	0.04	0.02		0.65	0.86	0.81	

E1- Rayakottai E2 – Oddanchatram E3 –Attur role in biological defense mechanism against nematode infection (Doke, 1985). In the present study, mean performance for root ascorbic acid content revealed that the hybrid HN2 × CLN 2123A (13.8 mg/100 g), the parent HN2 (12.6 mg/100 g) and the resistant check Hisaar Lalit (13.6 mg/100 g) registered higher values of root ascorbic acid content than other the parent CLN 213A (6.9mg/100 g), hybrids CLN 213A × HN2 (8.8mg/100 g), LCR2 × CLN 2123A (7.2 mg/100 g), the check hybrid Lakshmi (8.0 mg/100 g) and the susceptible cv. Co 3 (6.4 mg/100 g) (Table 5). Mean values of different locations also revealed that the hybrid HN2 × CLN 2123A (13.9 mg/100 g in Rayakottai, 13.7 mg/100 g in Oddanchatram and 13.6 mg/100 g in Attur), the resistant check Hisar Lalit (13.9 mg/100 g in Rayakottai, 13.7 mg/100 g in Oddanchatram and 13.3 mg/100g in Attur) and the parent HN2 (12.4 mg/100 g in Rayakottai, 13.0 mg/100 g in Oddanchatram and 12.3 mg/100 g in Attur) registered higher root ascorbic acid content than other genotypes. These results suggested that higher root ascorbic acid content exhibited by the hybrid HN2 × CLN 2123A might be due to the involvement of one good parent (HN2). This hybrid exhibited high × low parental *per se* for this trait indicating additive × dominant type of gene interaction. Increase in ascorbic acid oxidase after nematode infestation in tomato roots was also reported by Pankaj *et al*. (1998).

Peroxidase :

Host plant enzymes like peroxidase (PO) plays an important role in imparting disease resistance. The activity of peroxidase varied considerably and ranged

Table 6 : *per se* performance of parents, hybrids and check varieties/hybrids

Varieties	Peroxidase (changes in OD per mimutes per g of leaves)			Pooled mean	IAAO oxidase (µg unoxidisedauxin)			Pooled mean
	E1	E2	E3		E1	E2	E3	
CLN 2123 A	0.34	0.31	0.30	0.31	15.06	15.63	10.65	13.78
HN2	0.29	0.28	0.28	0.28	9.06	9.20	12.97	10.41
CLN 2123A x HN2	0.37	0.35	0.36	0.36	14.03	14.00	13.08	13.70
HN2 x CLN 2123A	0.42	0.38	0.38	0.39	9.13	9.33	10.63	9.69
LCR2	0.16	0.22	0.21	0.19	18.43	15.76	15.48	16.56
COTH2	0.35	0.32	0.31	0.32	15.33	15.40	11.18	13.97
Hisar Lalit	0.27	0.27	0.25	0.26	9.06	13.66	13.15	11.96
Lakshmi	0.47	0.37	0.36	0.40	15.93	16.00	16.31	16.08
CO_3	0.14	0.21	0.22	0.19	15.86	15.33	14.41	15.20
S.E.±	0.03	0.01	0.01		0.31	0.94	2.55	
C.D. (P=0.05)	0.06	0.04	0.02		0.67	1.99	5.40	

E1- Rayakottai E2 – Oddanchatram E3 - Attur

Table 7 : *per se* performance of parents, hybrids and check varieties/hybrids

Varieties	Acid phosphatase (*m*moles p-nitrophenol)			Pooled mean
	E1	E2	E3	
CLN 2123 A	36.78	30.36	29.51	32.22
HN2	90.22	82.90	82.86	85.33
CLN 2123A x HN2	74.69	63.06	62.79	66.85
HN2 x CLN 2123A	92.34	83.40	83.30	86.35
LCR2	40.12	21.33	19.73	27.06
COTH2	36.69	26.66	26.35	29.90
Hisar Lalit	92.66	82.26	82.18	85.70
Lakshmi	43.95	30.03	23.68	32.55
CO_3	38.40	17.16	21.11	25.56
S.E.±	5.43	1.96	2.18	
C.D. (P=0.05)	11.53	4.17	4.63	

E1- Rayakottai E2 – Oddanchatram E3 - Attur from 0.19 OD min^{-1} g^{-1} fesh weight to 0.40 OD min^{-1} g^{-1} fresh weight. Resistant check Hisar Lalit (0.40 OD min^{-1} g^{-1}fesh weight), parent HN2 (0.38 OD $min^{-1}g^{-1}$ fesh weight) and the cross HN2 × CLN 2123A (0.39 OD $min^{-1}g^{-1}$fesh weight) registered higher peroxidase activity than other genotypes of the study (Table 6). *per se* values of different locations showed that the hybrid HN2 × CLN 2123A (0.42OD min^{-1} g^{-1} fesh weight in Rayakottai, 0.38 OD min^{-1} g^{-1} fesh weight in Oddanchatram and 0.38 OD min^{-1} g^{-1} fesh weight in Attur), resistant check Hisar Lalit (0.47 OD min^{-1} g^{-1} fesh weight in Rayakottai, 0.37 OD min^{-1} g^{-1} fesh weight in Oddanchatram and 0.36 OD min^{-1} g^{-1} fesh weight in Attur) and the Parent HN2 (0.37 OD min^{-1} g^{-1} fesh weight in Rayakottai, 0.35 OD min^{-1} g^{-1} fesh weight in Oddanchatram and 0.36 OD min^{-1} g^{-1} fesh weight in Attur) recorded higher peroxidase activity than the other genotypes.Bajaj *et al*. (1985) reported that *Meloidogyne incognita* induced an increase of peroxidase activity in resistant tomato cultivars but a significant decrease in susceptible cultivars.

IAA oxidase:

Measurement of residual IAA in the roots is a good indication of resistance towards the nematode infection. IAA oxidase in resistant genotypes varied from 9.69 µg of unoxidisedauxin to 11.96 µg unoxidisedauxin and from 13.8 µg unoxidisedauxin to 16.1 µg unoxidisedauxin in susceptible genotypes. The cross HN2 × CLN 2123 A registered higher IAA oxidase activity (9.7 µg unoxidisedauxin) than the parent HN2 (10.4 µg unoxidisedauxin) and resistant check Hisar Lalit (12.0 µg unoxidisedauxin) (Table 6). The cross HN2 × CLN 2123A expressed higher IAA oxidase activity than the parent HN2 and resistant check Hisar Lalit thus, suggesting the superiority of the hybrid for this trait. Further, *per se* values of different locations showed that the hybrid HN2 × CLN 2123A (92.3 µg unoxidisedauxin in Rayakottai, 83.4 µg unoxidisedauxin in Oddanchatram and 83.3 µg unoxidisedauxin in Attur), the parent HN2 (90.2 µg unoxidisedauxin in Rayakottai, 82.9 µg unoxidisedauxin in Oddanchatram and 82.9 µg unoxidisedauxin in Attur) and the resistant check Hisar Lalit (92.7µg unoxidisedauxin in Rayakottai, 82.3 µg unoxidisedauxin in Oddanchatram and 82.2 µg unoxidisedauxin in Attur) registered higher IAA oxidase activity than the other genotypes. Similar results of higher IAA oxidase activity in nematode infested resistant cultivar than that of susceptible variety was reported by Viglierchio and YU (1965) and Ganguly and Dasgupta (1987).

Acid phosphatase activity:

The importance of acid phosphatase activity in imparting resistance to *Meloidogyne incognita* in tomato was reported by Ganguly *et al*. (2000). Higher acid phosphatase activity was exhibited by the cross HN2 × CLN 2123A (86.3 *m*moles) followed by the parent HN2 (85.3 *m*moles) and the resistant check variety Hisar Lalit (85.7 *m*moles). Mean values of different locations indicated that the cross HN2 × CLN 2123A (9.1 *m*moles in Rayakottai, 9.3 *m*moles in Oddanchatram and 10.6 *m*moles in Attur), the parent HN2 (9.1 *m*moles in Rayakottai, 9.2 *m*moles in Oddanchatram and 13.0 *m*moles in Attur) and the resistant check variety Hisar Lalit (9.1 *m*moles in Rayakottai, 13.7 *m*moles in Oddanchatram and 13.1 *m*moles in Attur) registered higher acid phosphatase activity than the other genotypes (Table 7). Swain *et al*. (2004) also reported a dramatic increase in the activity of IAA oxidase and acid phosphatase enzyme and their secondary metabolites of phenyl propenoid pathway soon after the infection of host plants with nematodes. The hybrid excelled both the parent in all the three locations of the study and suggested the presence of over dominant genes probably contributed by cytoplasm.

It could be concluded that the parent HN2, which registered lower root knot nematode incidence could be used as a potential ovule parent for developing root knot nematode resistant hybrids of tomato. The newly synthesized hybrid HN2 × CLN 2123A can be grown under root knot nematode infested area and during summer season (hot season for nematode infestation) as shown by the tolerance to root knot nematode infestation as it registered lower nematode disease incidence and being on par with the root knot nematode resistant check Hisar Lalit coupled with high yield.

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