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Evaluation of coriander (*Coriandrum sativum* L.) genotypes for resistance to stem gall disease and seed yield

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Abstract

A field experiment was conducted during three consecutive *Rabi* seasons (2002–03 to 2004–05) at Kumarganj, Faizabad, (UP). The coriander genotypes, received from All India Coordinated Research Project on Spices, were tested for resistance against stem gall disease and powdery mildew under natural condition. The promising genotypes were also tested at Dholi (Bihar), Hissar (Hariyana) and KVK and farmers field in Uttar Pradesh. The data on coriander genotypes revealed that genotype *K.Selection* showed lowest disease severity of stem gall 6.4% in 2002–03, 6.7% in 2003–04 and 6.8% in 2004–05. Whereas, pooled disease severity of stem gall in *K.Selection* during 2005–08 was 8.62% as compared with *Pant Haritma* (11.78%), UD-118 (18.78%), RD-154 (33.33%) and LCC-174 (37.46%). The yield performance of *K.Selection* in coordinated varietal trials at Kumarganj was significantly higher over the national check *Pant Haritma*. *K.Selection* also recorded higher seed yield at farmer's field (10.9%) and Krishi Vigyan Kendra (23.5%).

Keywords: powdery mildew, resistant, seed yield, stem gall

India is the biggest producer, consumer and exporter of coriander in the world producing 482 thousands metric tonnes from the 5305 thousand hectares and productivity of 0.9 metric tonnes per hectare in 2011–12 (Anonymous 2012). Major coriander growing states are Andhra Pradesh, Karnataka, Rajasthan, Gujarat, Madhya Pradesh, Uttar Pradesh, Bihar and Rajasthan. Although, the area and production of coriander is increasing year after year, the productivity is stagnant in spite of high yielding varieties and improved production technology. One of the major reasons is the incidence of many diseases.

Stem gall disease caused by *Protomyces macrosporus* Unger (a gall-forming fungus) is an important disease in coriander growing area of Madhya Pradesh and adjoining districts of Rajasthan and Uttar Pradesh. The disease is seed and soil borne and survives in the form of chlamydospores. The disease symptoms appear in the form of galls on stems, branches, leaves, petioles and fruits, which causes severe yield losses and also deteriorate the quality of seeds (Lakra 2000). Stem gall affected field has showed 23% disease intensity and average amount of loss per plant was approximately 15% (Gupta 1954). Gall of coriander causes tumour like

swelling on the seed and reduces yield up to 33-36% (Naqvi 1986). Breeding effort for high yielding varieties with resistance to stem gall disease in coriander are very limited. The control of *P. macrosporus* is difficult because of its seed and soil borne nature with rapid disease development. Intensive cultivation of the susceptible host crop and recurrence of the disease in the same field led to explore the possibility of identifying a high yielding variety with resistance against stem gall and powdery mildew with other desirable characteristics. The objective of this study was to evaluate the performance of coriander genotypes and identify the most promising genotypes.

The experiment was conducted at Vegetable farm of N.D. University of Agriculture and Technology, Kumarganj, Faizabad, (UP), during 2002–03 to 2004–05 with promising coriander genotypes including two checks. The trials were laid out in randomized block design with three replications. The crop was grown during *rabi* every year following recommended package of practices. Data were recorded on most of desirable characters like days to 50% flowering, plant height, no. of branches plant^{-1}, no. of umbel plant^{-1}, no. of umbelets umbel^{-1}, no of seed umbelet^{-1}, days to maturity and yield kg ha^{-1}. The stem gall incidence was recorded by counting number of plants showing gall on stem, leaves, inflorescence and seeds. Stem gall severity was measured on 100 point score where 3= healthy plant and 100= fully diseased on leaves, pedicle and fruits suggested by Gupta (1954). Powdery mildew was assessed on a 0-4 scale (0= no disease symptoms and 4= all the plant parts are covered with white powdery mass) as described earlier Kalra *et al.* (1997). These entries were simultaneously evaluated for yield during 2002–05 at Dholi, Bihar and Hissar, Haryana. The data were analysed and promising varieties were tested at KVK and farmer's field.

The pooled observations on seed yield, number of umbel plant^{-1}, number of umbellate umbel^{-1} and susceptibility to diseases of stem gall and powdery mildew are given in Table 1. The yield performance of *K.Selection* in Coordinated varietal trials at Kumarganj was found significantly higher by 3.5% in 2002–03, 4.0% in 2003–04 and 17.9% in 2004–05 over the national check *Pant Haritma* (Table 2). Stem gall severity of coriander was assessed from flowering to fruiting stage and lowest disease

Table 1. Performance of coriander genotypes *K-Selection* with check *Pant Haritma* and *H.Anand*

Characters	Coriander varieties			CD
	K.Selection	*Pant Haritma*	*H.Anand*	(P<0.05)
Days to 50% flowering	86.0	93.3	75.0	1.999
Plant height (cm.)	96.4	75.3	96.6	4.050
No. of branches plant^{-1}	2.3	1.9	4.4	1.306
No. of umbel plant^{-1}	51.2	50.6	34.4	3.665
No. of umbelets umbel^{-1}	5.6	4.4	3.6	1.196
No. of seeds umbel^{-1}	41.6	39.6	36.8	3.588
Yield (q ha^{-1})	18.0	11.8	10.8	2.612
Days to maturity	141.6	124.5	115	2.061
Seed size	Small	Medium	Bold	-
Stem gall incidence	8.6	27.7	46.8	2.382
Stem gall reaction grade	R	MS	MS	-
Powdery mildew incidence	20.3	28.7	58.2	2.879
Powdery mildew reaction grade	MR	S	HS	
Benefit : Cost ratio	1.79	1.36	1.20	0.292

Table 2. Yield of coriander genotypes *K.Selection* (*Narendra Dhania*-2) in All India Coordinated Varietal Trial (kg ha^{-1})

Variety	2002-03	2003-04	2004-05
K.selection	2080	2080	1710
LCC-128	1220	1220	1030
J.Cori-328	1750	1730	1350
LCC-225	1380	1390	1630
Pant Haritma (check)	2010	2000	1450
CD (P<0.05)	12.62	8.90	11.86
SEM	3.32	3.14	3.47
CV (%)	20.80	12.94	21.24

severity of 6.4% was found in 2002–03, 6.7% in 2003–04 and 6.8% in 2004–05 in *K.Selection* (Table 5). Whereas pooled disease severity of stem gall in *K.Selection* during 2005–08 was 8.6% as compared with *Pant Haritma* (11.8%), UD-118 (18.8%), RD-154 (33.3%) and LCC-174 (37.5%). Lakra (1999) reported that stem gall disease reduced the height of the plants, number of branches plant^{-1}, number of umbel branch^{-1}, number of umbellate umbel^{-1}, number of seeds umblets^{-1} and seed yield plant^{-1}. Stem gall reaction was graded as resistant in *K.Selection* as against moderately resistant variety *Pant Haritma* (Table 3). Disease severity of powdery mildew was also assessed and it was 20.33% in

Table 3. Pooled data of percent disease severity and reaction of stem gall and powdery mildew disease in coriander genotypes at Kumarganj center during 2005 to 2008

Genotypes	Stem gall		Powdery mildew	
	Disease severity (%)	Reaction resistant	Disease severity (%)	Reaction
K.Selection	8.6		20.3	MR
R.D-154	33.3	MS	24.6	MR
LCC-128	37.5	MS	28.9	MR
UD-118	18.7	MR	42.7	MS
Pant Haritma (check)	11.7	MR	27.8	MR
CD (P<0.05)	0.24		0.32	
SEM	0.07		0.10	
CV (%)	9.21		9.36	

0-No gall (Immune), 1-Gall on Stem (Resistant), 2-Gall on Stem + leaves (Moderate resistant), 3-Gall on stem + leaves + inflo. (Susceptible), 4- Gall on stem + leaves + inlflo. + Seed (Highly susceptible)

Table 4. Mean yield of *K.Selection* (*Narendra Dhania*-2) at different KVK and farmers field during 2009 to 2012 (kg ha^{-1})

Variety	KVK	Farmers field
K.Selection	1935.6	1828.7
LCC-128	1190.6	1510.5
J.Cori-328	1540.4	1430.3
LCC-225	1175.4	1210.1
Pant Haritma (check)	1745.7	1480.4
CD (P<0.05)	14.79	10.36
SEM	4.68	6.24
CV (%)	20.86	15.85

K.Selection and 27.80% in *Pant Haritma* which were graded as moderately resistant. Infection occurs as whitish circular patches on leaves and stems, and later white powdery mass appears. Total loss of crop occurs in case of death of plants (Raju *et al.* 1982). The tested variety of coriander *K.Selection* showed higher seed yield in comparison to respective check in all the zones, which was 13.3% to 14.38% in Dholi (Bihar) and 11.7% to 15.8% in Hissar (Hariyana). Duration of maturity was recorded 141.6 days in *K.Selection*, 124.5 days in *Pant Haritma* and 92 days in *Hissar Anand*. The seed size of *K.Selection* was small with bright while medium in *Pant Haritma* and bold in *Hissar*

Table 5. Percent disease severity and disease reaction of stem gall in coriander genotypes at Kumarganj center during 2002 to 2005

Genotypes	2002-03		2003-04		2004-05	
	Stem gall severity (%)	Reaction	Stem gall severity (%)	Reaction	Stem gall severity (%)	Reaction
K.Selection	6.5	R	6.7	R	6.8	R
LCC-128	39.3	MS	39.5	MS	38.5	MS
J.Cori-328	19.1	MR	19.5	MR	20.2	MR
LCC-225	25.2	MS	24.1	MR	26.2	MS
R.D-154	20.2	MR	20.1	MR	22.0	MR
UD-118	33.6	MS	32.0	MS	33.6	MS
Pant Haritma (check)	13.6	MR	15.2	MR	16.3	MR
CD (P<0.05)	5.58		9.20		6.62	
SEm±	1.77		2.92		2.10	

0%- (Immune); 1-10% (Resistant); 10.1-25% (Moderate Resistant); 25.1-50% (Moderate Susceptible); More than 50% (Susceptible)

Anand. Performance of *K.Selection* in case of seed yield was found better than (Table 4) the other tested genotypes at farmer's field and Krishi Vigyan Kendra.

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