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ISSN: 0974-4908
Res. Environ. Life Sci.
9(4) 426-428 (2016)

Evaluation of coriander accessions for resistance against stem gall disease (*Protomyces macrosporus* Unger) under Hill zone of Karnataka

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(Received: August 25, 2015; Revised received: February 08, 2016; Accepted: February 11, 2016)

Abstract: Coriander (*Coriandrum sativum* L.) is an annual spice herb that belongs to the family Umbelliferae. Even though Ethiopia is a centre of primary diversity for the crop, the current knowledge about its biology, variety development and agronomy is neither complete nor conclusive under ethiopian conditions. To contribute to filling some of the existing gaps, a field experiment was conducted during the year of 2011-12 a seventy one accessions of coriander were screened for resistance against stem gall, a sever disease caused by *Protomyces macrosporus* Unger., with the goal to select the resistant cultivars. The accessions DCC-37 (Devihosuru coriander collection), DCC-49 and DCC-51, DCC-10, DCC-32 and Sudha were highly resistant. These may be used as the parents to breed high yielding accessions resistant to stem gall disease.

Key words: Evaluation, Coriander, accessions, *Protomyces macrosporus* Unger, Stem gall

Introduction

Coriander (*Coriandrum sativum* L.), a member of family Umbelliferae (Apiaceae), is one of the major seed spice crops in India (Raghavan, 2000). It is used as condiment in the preparation of curry powder, pickles, sausages and seasonings. Seeds are also used in the preparation of confectionary and liquors. Due to its pleasant aroma, tender shoots and leaves are used in chutney, soups and salads (Marufi *et al*., 2010 and Chawla *et al*., 2013). Its seeds are used for extracting essential oil for its linalool content (Meena *et al*., 2010). The crop yield is limited by a number of fungal diseases (Bilgrami *et al.,* 1991 and Lakra, 2001) of which the stem gall disease caused by *Protomyces macrosporus* Unger., is the most destructive one reducing crop yield and quality of the essential oil (Kalra *et al*., 1999). Efforts have been made to screen and select resistant cultivars of coriander against the stem gall disease in green house (Gupta and Sinha, 1964) and in field experiments (Gupta and Sinha, 1973; Naqvi 1996; Kalra *et al.,* 1999) on a limited scale. Naqvi (1996) screened 20 accessions of coriander against stem gall disease and reported that none of the accessions were resistant. Only four were reported to be moderately resistant. Kalra *et al*. (1999) have reported only two accessions (C-1 and Pant-1) out of sixteen selected to be highly resistant against the disease.

Material and Methods

In the present investigation seventy one accessions of coriander obtained from different regions of Karnataka, were sown in the field of the College of Horticulture, Mudigere (Karnataka) during 2011-12 and screened for resistance to stem gall disease. The College of Horticulture, Mudigere situated at 13^0 252 Northern latitude, 75^0 452 East longitude and at an altitude of 976 meter above mean sea level. The soil type sandy loam soil having $_PH$ 5.5 to 6.00. The soil is poor in organic carbon (0.58%) with low availability nitrogen (156.8 kg/ha). The porosity is low and is the reason for the low availability of the existing nutrients, which limit the growth and establishment of the plants.

Healthy (un-inoculated) seeds of 71 accessions of *Coriandrum sativum* L. were sown on 1 week of November 2012 in randomized block design with two replications. The plot size was 2 X 1 m^2 with spacing of 30 cm between the rows and 15 cm between the plants. After weeding and thinning 10 -12 plants per row were maintained. Observations on plant height, branches per plant, seed yield kg per hectare and disease incidence were recorded on three randomly selected plants of each replication. The data were analyzed according to Panse and Sukhatme (1967) and was calculated according to Singh and Choudhary (1977).

Stem gall intensity on the crop was calculated on a 100-point scale as devolved by Gupta (1954). One whole plant with a total score of 100 points was divided into three parts; main stem (40 points), pedicles (20 points) and fruits (40 points). The scoring on the stem depended on the extent and density of tumors, for pedicles on the length diseased and for fruits on the approximate number diseased in relation to total number of fruits formed. Thus a fully diseased plant scores 100 points if the tumors are densely distributed along the whole length of the stem, and all the pedicles and fruits are diseased. A healthy plant without any symptom scores a total of 3 points, one for each of the three parts similar to the method followed by Naumov (1924).

Results and Discussion

Analysis of variance of treatment (Table-1) was found significantly superior for all the characters indicating that there is much variability to take up further genetic studies involving these accessions. The different accessions of coriander were observed to have variable degree of resistance to the stem gall disease. In highly susceptible accessions, the symptom appeared in the form of small tumor like swelling on the leaf veins, stalks, pedicles, stem as well as on fruits. The galls were present on all the above ground plant parts measuring 3-15 mm on highly susceptible cultivars. In resistance accessions no visible galls were produced. The seed yield per plant ranged from 3.11 to 7.14 g/plant (Table-2). The maximum seed yield was noticed for DCC-49 (7.14) followed by DCC 32 (7.09), DCC 57 (7.02) etc. The highly yield in most of the cases was related to the more number of branches or plant height. The above reports are in earlier findings with Palanikumar *et al.* (2012).

The accessions DCC 37, DCC 49 DCC 51, DCC 32, DCC 10 and Sudha (Table 2) were found to be highly resistant as the stem gall intensity values were 3. The correlation coefficients between different parameters and stem gall intensity are given in Table 3. A

Table-1: Analysis of variance (ANOVA) for different characters of coriander accessions

Source of variation	Characters				
	Degree of freedom	Plant height MS value	Branches /plant MS value	Seed yield /plant MS value	Disease incidence MS value
Replication	1	28.27	8.32	30.63	25.28
Genotypes	70	43.10**	50.91**	45.77**	41.36**
Error	70	15.35	3.35	22.19	8.56

**Significant at $P = 0.01$ probability level

Table-2: Varietal reactions of different coriander accessions against stem gall disease

Coriander accessions	Origin	Plant height (cm)	Branches/ plant	Seed yield /plant (g)	Stem gall intensity
Varieties					
RCr-435	RAU, RJ	35.10	8.94	4.25	35
RCr-436	RAU, RJ	36.60	8.38	4.85	38
RCr-446	RAU, RJ	39.95	8.34	4.66	40
Sadhana	ARS, Lam	35.43	7.11	4.86	65
Sindhu	ARS, Lam	35.01	6.99	4.29	57
Sudha	ARS, Lam	43.95	9.31	6.21	3
CO-1	TNAU	33.23	7.28	4.74	55
CO-2	TNAU	33.45	6.61	4.91	70
CO-4	TNAU	38.29	8.33	5.19	39
DWD-3	UAS, Dharwad	35.35	5.09	3.87	49
Cultivars					
Dharwad local-3	Local collection of Dharwad	32.89	5.80	3.95	88
Tarikere local	Local collection of Tarikere	32.06	5.04	3.11	85
Germ plasm accessions					
Devihosuru Coriander Collection					
DCC -1	Devihosuru	37.10	7.16	5.43	65
DCC 2	Devihosuru	32.89	6.13	3.60	72
DCC 3	Devihosuru	41.60	9.57	6.59	5
DCC 4	Devihosuru	42.60	6.68	5.80	9
DCC 5	Devihosuru	40.40	9.90	6.76	4
DCC 6	Devihosuru	45.60	9.57	6.53	4
DCC 7	Devihosuru	41.90	8.44	4.75	12
DCC 8	Devihosuru	38.70	9.68	7.09	18
DCC 9	Devihosuru	39.90	8.44	6.62	22
DCC 10	Devihosuru	40.00	8.69	6.60	3
DCC 11	Devihosuru	43.30	8.70	6.58	7
DCC 12	Devihosuru	40.50	9.08	6.56	9
DCC 13	Devihosuru	31.39	8.73	5.69	34
DCC 14	Devihosuru	42.20	8.21	5.61	12
DCC 15	Devihosuru	45.60	8.08	6.25	9
DCC 16	Devihosuru	38.90	6.20	4.80	34
DCC 17	Devihosuru	39.40	10.22	6.82	8
DCC 18	Devihosuru	37.50	6.19	4.57	57
DCC 19	Devihosuru	36.10	9.48	6.90	4
DCC 20	Devihosuru	34.80	8.60	6.23	56
DCC 21	Devihosuru	45.10	7.76	5.06	20
DCC 22	Devihosuru	38.80	7.12	5.13	34
DCC 23	Devihosuru	39.90	9.01	6.58	37
DCC 24	Devihosuru	34.80	7.01	4.52	68
DCC 25	Devihosuru	45.10	7.10	5.43	16
DCC 26	Devihosuru	37.34	8.09	3.60	44
DCC 27	Devihosuru	45.60	8.89	6.59	15
DCC 28	Devihosuru	43.60	6.79	5.80	32
DCC 29	Devihosuru	42.70	7.17	6.76	21
DCC 30	Devihosuru	36.50	9.30	6.53	40
DCC 31	Devihosuru	41.80	7.05	4.75	19
DCC 32	Devihosuru	43.50	7.03	7.09	3
DCC 33	Devihosuru	38.30	8.00	6.62	54
DCC 34	Devihosuru	41.10	7.34	6.60	19
DCC 35	Devihosuru	34.20	8.35	6.58	46
DCC 36	Devihosuru	37.90	8.97	6.56	43
DCC 37	Devihosuru	42.09	10.41	5.42	3
DCC 38	Devihosuru	45.70	8.49	4.56	27
DCC 39	Devihosuru	43.10	9.56	5.23	21
DCC 40	Devihosuru	43.80	8.87	6.35	17
DCC 41	Devihosuru	43.70	9.71	4.59	37
DCC 42	Devihosuru	32.51	7.35	6.73	52
DCC 43	Devihosuru	35.20	7.05	5.48	46
DCC 44	Devihosuru	39.00	10.05	5.30	41
DCC 45	Devihosuru	38.44	7.46	5.99	49
DCC 46	Devihosuru	45.10	9.68	4.42	5
DCC 47	Devihosuru	43.90	10.09	6.39	4
DCC 48	Devihosuru	37.90	8.39	6.61	33
DCC 49	Devihosuru	39.84	10.45	7.14	3
DCC 51	Devihosuru	43.80	10.21	6.63	3
DCC 52	Devihosuru	41.20	6.34	5.86	11
DCC 53	Devihosuru	38.30	8.41	6.44	38
DCC 54	Devihosuru	41.80	6.62	6.48	13
DCC 55	Devihosuru	39.30	6.97	3.57	48
DCC 56	Devihosuru	37.88	8.82	4.46	35
DCC 57	Devihosuru	36.73	8.04	7.02	4
DCC 58	Devihosuru	40.10	9.52	4.37	6
DCC 59	Devihosuru	41.10	9.96	6.63	8
DCC 60	Devihosuru	38.30	6.89	6.62	28
Mean		39.44	8.14	5.62	
SE ±		2.77	0.41	0.52	
CD at 5%		7.81	1.17	1.48	
CV (%)		9.93	7.18	13.20	

Table-3: Correlation coefficients (r) between (i) Plant height (ii) branches/ plant (iii) seed yield/plant and disease intensity

	Branches /plant	Seed yield /plant	Disease intensity
Plant height	0.216*	0.237*	-0.02514
Branches/plant		0.241*	-0.02896
Seed yield/plant			-0.03163**
Disease intensity			

*Significant at *P* = 0.01 probability level; **Significant at *P* = 0.05 probability level

perusal of the table indicates that the stem gall disease intensity increased the seed yield, plant height and number of branches decreased. This decrease was significant for the seed yield but non-significant for the other two parameters. The seed yield per plant, however, was positively correlated with plant height and branches per plant. The above reports are in earlier findings with Soni and Verma (2010), Jain *et al*. (2014), Yadav *et al*. (2014) Kapadiya *et al*. (2013) and Singh *et al*. (1995). The highly susceptible accessions were Tarikere local, Dharwad local, Co-2 and Sadhana with high stem gall intensity. The survey indicates that the germ plasma accessions, which are much more acclimatized to local area, proved more resistant to the stem gall disease.

All the resistant accessions with good yield have been processed in different programmes to develop high yielding varieties and stem gall resistant accessions. On the other hand the resistant accessions with average yield may be utilized as donor parent to isolate desirable recombinants.

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