

Evaluation of Coriander Germplasm Against Stem Gall Disease of Coriander (*Coriandrum sativum* L.)

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One hundred two germplasm of coriander (*Coriandrum sativum* L.) were screened for resistance against stem gall, a severe disease caused by *Protomyces macrosporus* Unger. Out of 102 germplasm of coriander, thirty five germplasm of coriander showed moderately susceptible reaction to stem gall disease namely ND Cor- 9,13, 14, 15, 18, 19, 20, 22, 23, 24, 25, 27, 34, 38, 49, 60, 61, 64, 65, 67,70, 71, 73, 76, 81, 82, 86, 88,94, 95, 96, 97, 98, 99, 101 whereas, sixty seven germplasm of coriander were observed susceptibility to stem gall disease of coriander e.g., ND Cor- 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 16, 17, 21, 26,28, 29, 30, 31, 32, 33, 35, 36, 37, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 62, 63, 66, 68, 69, 72, 74, 75, 77, 78, 79, 80, 83, 84, 85, 87, 89, 90, 91, 92, 93, 100, 102. Minimum per cent disease intensity of 27.5% of stem gall disease was recorded in NDCor-18 and NDCor-76 whereas maximum per cent disease intensity of 82.5 was recorded in NDCor-32 showing maximum susceptibility among the germplasm. Rest of the germplasm ranged in between 25.0 - 82.5 % PDI.

Keywords: Coriander, Germplasm collection, *Protomyces macrosporus*, Stemgall.

Coriander (*Coriandrum sativum* L.; Family: Apiaceae) also known as is an annual herb. Coriander is native to regions spanning from southern Europe and North Africa to southwestern Asia. It is a soft plant growing to 50 cm height. The leaves are variable in shape, broadly lobed at the base of the plant, and slender and feathery higher on the flowering stems. Although sometimes eaten alone, the seeds often are used as a spice or an added ingredient in other foods. Stem gall disease (*Protomyces macrospores* Unger) is one of the important coriander diseases in India and often causes severe yield loss and deteriorate the quality of seed. The disease is soil and seed borne in nature

and manifests itself in the form of tumours on stem, branches, leaves, petioles and fruits deteriorating the quality of seed. Coriander is an important spice crop grown in several countries, such as India, Morocco, Russia and Turkey (Aiyar, 1958). A disease of coriander called stem-gall caused by *Protomyces macrospores* Unger is widespread in India. The causal fungus produces hypertrophy in stem, leaves, inflorescence and fruits. Efforts have been made to screen and select resistant cultivars of coriander against the stem gall disease in greenhouse (Gupta and Sinha, 1973) and in field experiments experiments (Gupta and Sinha, 1973; Gupta, 1954; Kalra, *et al*, 1999) on a limited scale. 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(Gupta, 1954). Only two

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accessions (C-1 and Pant-1) out of sixteen selected to be highly resistant against the disease (Kalra, *et al*, 1999). The stem gall disease appear as tumour like outgrowth on stem extending to leaves (thick and leathery) to inflorescence and seeds. The seeds are hypertrophied or hyperplased depending upon stage of infection. Infected seeds are larger than normal seeds. Infected seed posses high concentration of amino acid, reducing sugar and low concentration of non-reducing and total sugar there by reducing the quality of seeds produced (Pavgi and Muthopadhyay, 1972; Goel *et al*, 1983) and as a result loose their value for use as a seed and for consumption.

Studies undertaken during the last few years on stem gall disease shows that disease appear regularly every year in the fields of coriander causing heavy losses in Eastern U.P (Chattopadhyay and Maiti, 1990; Saxena *et al* 2002). Since the disease cause severe damages at all the stages of growth and therefore, needs immediate attention on the management to reduce losses/ crop damage.

MATERIALS AND METHODS

Experiments were conducted during *Rabi* season at Main Experiment Station of Department of Vegetable Science (Main Campus), Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad which is located at latitude of 26°-47°, North latitude 82.12° East longitude and Altitude of 113 meters from mean sea level in the north Indo-Gangetic plains of Eastern Uttar Pradesh. The centre is classified under sub-tropical zone being often subjected to extremes of weather conditions *i.e.* hot summer and cold winter. The Eastern region enjoys sub-tropical climate with an average annual rainfall of around 1100-1200 mm. The total rainfall received during the course of experimentation from Oct to March was 14.0 mm. The winter months were cold with occasional frost during the month of December and January. The meteorological data such as maximum and minimum temperature distribution of rainfall, relative humidity and sunshine hours recorded during crop period.

Screening of germplasm disease

Seeds of different germplasm of coriander maintained in the Department of Vegetable Science

in All India Coordinated Research Project on spices crops, representing different localities were used for study. The seeds harvested in last season were used as experimental seed materials. Altogether, one hundred two germplasm of coriander were sown to screen the incidence of stem gall and other diseases at Main Experimental Station, Kumarganj of this university. In the present studies variety Check-1(UD-743) and Check-2 (Hisar Anand) were used as checks. No seed treatment was given in screening of germplasm for disease incidence trial.

Layout and sowing

Seed were sown in ten blocks of 10 germplasm each with two checks Check-1(UD-743) and Check-2 (Hisar Anand) in augmented design as line sowing in two rows with spacing of 40 x 20 cm. A good crops stand was raised using good agronomical practices for coriander crops. FYM : 10 t/ha, Fertilizer: 50:30:30 kg NPK/ha, Irrigation: as & when required.

Observations recorded

The crop was watched closely to record first appearance of disease after germination and observation were made at the time of maturity of crop by random selection of 20 plants of each germplasm as per method described (Anonymous, 2004). The severity of disease was recorded at the time of maturity as the final observation and PDI calculated as below:

$$PDI = \frac{\text{Sum of numerical rating}}{\text{Total number of plants examined} \times \text{maximum rating}} \times 100$$

RESULTS AND DISCUSSION

Screening of germplasm of coriander against stem gall

A total of 102 germplasm of coriander were evaluated against stem gall disease under natural field condition. Observations on incidence of stem gall disease were recorded on germplasm. All the germplasm did not showed disease incidence uniformly and there were variation in date of first appearance of disease, and disease severity. Moreover, in one germplasm like NDCor-12 it was observed that symptoms of disease appeared on inflorescence directly without appearing any protuberances or any gall on the stem of the plants. Germplasm like ND Cor-18 showed lesion on the stems only. Check-1(UD-743) and Check-2 (Hisar Anand) were used as susceptible check and

Table 1: Layout of germplasm of coriander

| S. No | Accession | | |
|-------|------------------|-----|------------------|
| | | 51 | Check-1, Check-2 |
| | | 52 | ND Cor-51 |
| | | 53 | ND Cor-52 |
| | | 54 | ND Cor-53 |
| 1 | ND Cor-1 | 55 | ND Cor-54 |
| 2 | ND Cor-2 | 56 | ND Cor-55 |
| 3 | ND Cor-3 | 57 | ND Cor-56 |
| 4 | ND Cor-4 | 58 | ND Cor-57 |
| 5 | ND Cor-5 | 59 | ND Cor-58 |
| 6 | ND Cor-6 | 60 | ND Cor-59 |
| 7 | ND Cor-7 | | ND Cor-60 |
| 8 | ND Cor-8 | | Check-1, Check-2 |
| 9 | ND Cor-9 | 61 | ND Cor-61 |
| 10 | ND Cor-10 | 62 | ND Cor-62 |
| | Check-1, Check-2 | 63 | ND Cor-63 |
| 11 | ND Cor-11 | 64 | ND Cor-64 |
| 12 | ND Cor-12 | 65 | ND Cor-65 |
| 13 | ND Cor-13 | 66 | ND Cor-66 |
| 14 | ND Cor-14 | 67 | ND Cor-67 |
| 15 | ND Cor-15 | 68 | ND Cor-68 |
| 16 | ND Cor-16 | 69 | ND Cor-69 |
| 17 | ND Cor-17 | 70 | ND Cor-70 |
| 18 | ND Cor-18 | | Check-1, Check-2 |
| 19 | ND Cor-19 | 71 | ND Cor-71 |
| 20 | ND Cor-20 | 72 | ND Cor-72 |
| | Check-2, Check-1 | 73 | ND Cor-73 |
| 21 | ND Cor-21 | 74 | ND Cor-74 |
| 22 | ND Cor-22 | 75 | ND Cor-75 |
| 23 | ND Cor-23 | 76 | ND Cor-76 |
| 24 | ND Cor-24 | 77 | ND Cor-77 |
| 25 | ND Cor-25 | 78 | ND Cor-78 |
| 26 | ND Cor-26 | 79 | ND Cor-79 |
| 27 | ND Cor-27 | 80 | ND Cor-80 |
| 28 | ND Cor-28 | | Check-2, Check-1 |
| 29 | ND Cor-29 | 81 | ND Cor-81 |
| 30 | ND Cor-30 | 82 | ND Cor-82 |
| | Check-1, Check-2 | 83 | ND Cor-83 |
| 31 | ND Cor-31 | 84 | ND Cor-84 |
| 32 | ND Cor-32 | 85 | ND Cor-85 |
| 33 | ND Cor-33 | 86 | ND Cor-86 |
| 34 | ND Cor-34 | 87 | ND Cor-87 |
| 35 | ND Cor-35 | 88 | ND Cor-88 |
| 36 | ND Cor-36 | 89 | ND Cor-89 |
| 37 | ND Cor-37 | 90 | ND Cor-90 |
| 38 | ND Cor-38 | | Check-1, Check-2 |
| 39 | ND Cor-39 | 91 | ND Cor-91 |
| 40 | ND Cor-40 | 92 | ND Cor-92 |
| | Check-2, Check-1 | 93 | ND Cor-93 |
| 41 | ND Cor-41 | 94 | ND Cor-94 |
| 42 | ND Cor-42 | 95 | ND Cor-95 |
| 43 | ND Cor-43 | 96 | ND Cor-96 |
| 44 | ND Cor-44 | 97 | ND Cor-97 |
| 45 | ND Cor-45 | 98 | ND Cor-98 |
| 46 | ND Cor-46 | 99 | ND Cor-99 |
| 47 | ND Cor-47 | 100 | ND Cor-100 |
| 48 | ND Cor-48 | | Check-2, Check-1 |
| 49 | ND Cor-49 | 101 | ND Cor-101 |
| 50 | ND Cor-50 | 102 | ND Cor-102 |

Table 2: Disease scaling rate for stem gall (Anonymous, 2004)

| S.No. | Score | Code | Description |
|-------|-------|------|--------------|
| 1. | 0 | F | Disease free |
| 2. | 1 | R | 1-5.0 |
| 3. | 2 | MR | 5.1-20 |
| 4. | 3 | MS | 20.1-50 |
| 5. | 4 | S | >50 |

F = Disease free , R = Resistant, MR = Moderately resistant, MS = Moderately susceptible, S = Susceptible

showed susceptible reaction to stem gall disease under natural field conditions of Kumarganj, Faizabad.

Minimum per cent disease intensity of 27.5% of stem gall disease was recorded in NDCor-18 and NDCor-76 whereas maximum per cent disease intensity of 82.5 was recorded in NDCor-32 showing maximum susceptibility among the germplasm. Rest of the germplasm ranged in between 25.0 - 82.5 % PDI.

Results presented in the Table 4 revealed

Table 3. Plant disease intensity of coriander germplasm against stem gall disease

| S. No | Accession | PDI | Reaction | S. No | Accession | PDI | Reaction |
|-------|-----------|------|----------|-------|-----------|------|----------|
| 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 1 | ND Cor-1 | 65.0 | S | 19 | ND Cor-19 | 35.0 | MS |
| 2 | ND Cor-2 | 57.0 | S | 20 | ND Cor-20 | 50.0 | MS |
| 3 | ND Cor-3 | 60.0 | S | | Check-2 | 45.0 | MS |
| 4 | ND Cor-4 | 62.5 | S | | Check-1 | 85.0 | S |
| 5 | ND Cor-5 | 65.0 | S | 21 | ND Cor-21 | 52.5 | S |
| 6 | ND Cor-6 | 65.0 | S | 22 | ND Cor-22 | 47.5 | MS |
| 7 | ND Cor-7 | 52.5 | S | 23 | ND Cor-23 | 37.5 | MS |
| 8 | ND Cor-8 | 55.0 | S | 24 | ND Cor-24 | 45.0 | MS |
| 9 | ND Cor-9 | 47.5 | MS | 25 | ND Cor-25 | 37.5 | MS |
| 10 | ND Cor-10 | 62.5 | S | 26 | ND Cor-26 | 72.5 | S |
| | Check-1 | 85.0 | S | 27 | ND Cor-27 | 40.0 | MS |
| | Check-2 | 45.0 | S | 28 | ND Cor-28 | 57.5 | S |
| 11 | ND Cor-11 | 55.0 | S | 29 | ND Cor-29 | 55.0 | S |
| 12 | ND Cor-12 | 65.0 | S | 30 | ND Cor-30 | 55.0 | S |
| 13 | ND Cor-13 | 35.0 | MS | | Check-1 | 85.0 | S |
| 14 | ND Cor-14 | 30.0 | MS | | Check-2 | 47.5 | MS |
| 15 | ND Cor-15 | 37.5 | MS | 31 | ND Cor-31 | 80.0 | S |
| 16 | ND Cor-16 | 67.5 | S | 32 | ND Cor-32 | 82.5 | S |
| 17 | ND Cor-17 | 72.5 | S | 33 | ND Cor-33 | 60.0 | S |
| 18 | ND Cor-18 | 25.0 | MS | 34 | ND Cor-34 | 50.0 | MS |
| 35 | ND Cor-35 | 75.0 | S | 55 | ND Cor-55 | 60.0 | S |
| 36 | ND Cor-36 | 75.0 | S | 56 | ND Cor-56 | 55.0 | S |
| 37 | ND Cor-37 | 70.0 | S | 57 | ND Cor-57 | 70.0 | S |
| 38 | ND Cor-38 | 47.5 | MS | 58 | ND Cor-58 | 60.0 | S |
| 39 | ND Cor-39 | 80.0 | S | 59 | ND Cor-59 | 80.0 | S |
| 40 | ND Cor-40 | 67.5 | S | 60 | ND Cor-60 | 45.0 | MS |
| | Check-2 | 45.0 | MS | | Check-1 | 87.5 | S |
| | Check-1 | 87.5 | S | | Check-2 | 47.5 | MS |
| 41 | ND Cor-41 | 60.0 | S | 61 | ND Cor-61 | 47.5 | MS |
| 42 | ND Cor-42 | 60.0 | S | 62 | ND Cor-62 | 67.5 | S |
| 43 | ND Cor-43 | 70.0 | S | 63 | ND Cor-63 | 75.0 | S |
| 44 | ND Cor-44 | 72.5 | S | 64 | ND Cor-64 | 37.5 | MS |
| 45 | ND Cor-45 | 67.5 | S | 65 | ND Cor-65 | 27.5 | MS |
| 46 | ND Cor-46 | 75.0 | S | 66 | ND Cor-66 | 52.5 | S |
| 47 | ND Cor-47 | 70.0 | S | 67 | ND Cor-67 | 47.5 | MS |
| 48 | ND Cor-48 | 67.5 | S | 68 | ND Cor-68 | 55.0 | S |
| 49 | ND Cor-49 | 35.0 | MS | 69 | ND Cor-69 | 65.0 | S |

| | | | | | | | |
|----|-----------|------|----|----------------------------|------------|------|----|
| 50 | ND Cor-50 | 65.0 | S | 70 | ND Cor-70 | 47.5 | MS |
| | Check-1 | 82.5 | S | | Check-1 | 85.0 | S |
| | Check-2 | 47.5 | S | | Check-2 | 47.5 | MS |
| 51 | ND Cor-51 | 72.5 | S | 71 | ND Cor-71 | 45.0 | MS |
| 52 | ND Cor-52 | 62.5 | S | 72 | ND Cor-72 | 57.5 | S |
| 53 | ND Cor-53 | 65.0 | S | 73 | ND Cor-73 | 47.5 | MS |
| 54 | ND Cor-54 | 62.5 | S | 74 | ND Cor-74 | 62.5 | S |
| 75 | ND Cor-75 | 57.5 | S | 95 | ND Cor-95 | 40.0 | MS |
| 76 | ND Cor-76 | 27.5 | MS | 96 | ND Cor-96 | 42.5 | MS |
| 77 | ND Cor-77 | 72.5 | S | 97 | ND Cor-97 | 42.5 | MS |
| 78 | ND Cor-78 | 60.0 | S | 98 | ND Cor-98 | 50.0 | MS |
| 79 | ND Cor-79 | 72.5 | S | 99 | ND Cor-99 | 50.0 | MS |
| 80 | ND Cor-80 | 80.0 | S | 100 | ND Cor-100 | 55.0 | S |
| | Check-2 | 47.5 | MS | | Check-2 | 82.5 | S |
| | Check-1 | 87.5 | S | | Check-1 | 45.0 | MS |
| 81 | ND Cor-81 | 35.0 | MS | 101 | ND Cor-101 | 35.0 | MS |
| 82 | ND Cor-82 | 27.5 | MS | 102 | ND Cor-102 | 52.0 | S |
| 83 | ND Cor-83 | 62.5 | MS | MS =Moderately Susceptible | | | |
| 84 | ND Cor-84 | 57.5 | MS | S =Susceptible | | | |
| 85 | ND Cor-85 | 70.0 | S | | | | |
| 86 | ND Cor-86 | 42.5 | MS | | | | |
| 87 | ND Cor-87 | 62.5 | S | | | | |
| 88 | ND Cor-88 | 50.0 | MS | | | | |
| 89 | ND Cor-89 | 80.0 | S | | | | |
| 90 | ND Cor-90 | 70.0 | S | | | | |
| | Check-1 | 85.0 | S | | | | |
| | Check-2 | 47.5 | MS | | | | |
| 91 | ND Cor-91 | 55.0 | S | | | | |
| 92 | ND Cor-92 | 57.5 | S | | | | |
| 93 | ND Cor-93 | 57.5 | S | | | | |
| 94 | ND Cor-94 | 47.5 | MS | | | | |

that out of 102 germplasm of coriander, thirty five germplasm of coriander showed moderately susceptible reaction to stem gall disease namely ND Cor- 9,13, 14, 15, 18, 19, 20, 22, 23, 24, 25, 27, 34, 38, 49, 60, 61, 64, 65, 67, 70, 71, 73, 76, 81, 82, 86, 88, 94, 95, 96, 97, 98, 99, 101 whereas, sixty seven germplasm of coriander were observed susceptible to stem gall disease of coriander e.g.,

ND Cor- 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 16, 17, 21, 26, 28, 29, 30, 31, 32, 33, 35, 36, 37, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 62, 63, 66, 68, 69, 72, 74, 75, 77, 78, 79, 80, 83, 84, 85, 87, 89, 90, 91, 92, 93, 100, 102.

Altogether 102 germplasm were screened and evaluated for their tolerance against stem gall disease under natural field condition. Observation

Table 4. Evaluation of coriander germplasm against stem gall disease

| | | | |
|---|------------------------|---------|---|
| 0 | Healthy | 0 | Nil |
| 1 | Resistant | 1-5.0 | Nil |
| 2 | Moderately resistant | 5.1-20 | Nil |
| 3 | Moderately susceptible | 20.1-50 | ND Cor- 9,13, 14, 15, 18, 19, 20, 22, 23, 24, 25, 27, 34, 38, 49, 60, 61, 64, 65, 67, 70, 71, 73, 76, 81, 82, 86, 88, 94, 95, 96, 97, 98, 99, 101 |
| 4 | Susceptible | >50 | ND Cor- 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 16, 17, 21, 26, 28, 29, 30, 31, 32, 33, 35, 36, 37, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 62, 63, 66, 68, 69, 72, 74, 75, 77, 78, 79, 80, 83, 84, 85, 87, 89, 90, 91, 92, 93, 100, 102. |

have clearly indicated that the time of first appearance of disease was after 55 days of sowing. All the germplasm did not showed incidence / appearance uniformly and there was variation in time of appearance of disease showing differential tolerance of the germplasm for symptoms to appear on plant. ND Cor-12 showed disease symptoms directly on inflorescence (i.e. Late in disease appearance) without showing any symptoms on leaves and stem. On the other hand ND Cor-18 symptoms were confined on the stem only. This showed the inherited tolerance of the accession to stem gall disease. This germplasm also showed minimum PDI of 27.5 per cent. Varying degree of tolerance in germplasm of coriander are supported by work carried out by other workers at different locations. (Gupta, 1954., Gupta and Sinha, 1973., Naqvi, 1986., Patel *et al.* 1998., Singh and Jhakar, 1956., Tripathi, 2003., Tripathi *et al.* 1998).

CONCLUSIONS

A total 102 germplasm were screened for stem gall disease against susceptible check during Rabi season. None of the germplasm was found resistant, moderately resistant to disease. Out of 102 germplasm screened under natural field condition against stem gall disease thirty five germplasm of coriander showed moderately susceptible reaction to stem gall disease namely ND Cor-9,13, 14, 15, 18, 19, 20, 22, 23, 24, 25, 27, 34, 38, 49, 60, 61, 64, 65, 67, 70, 71, 73, 76, 81, 82, 86, 88, 94, 95, 96, 97, 98, 99, 101 whereas, sixty seven germplasm of coriander were observed susceptible to stem gall disease of coriander e.g., ND Cor- 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 16, 17, 21, 26, 28, 29, 30, 31, 32, 33, 35, 36, 37, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 62, 63, 66, 68, 69, 72, 74, 75, 77, 78, 79, 80, 83, 84, 85, 87, 89, 90, 91, 92, 93, 100 and 102.

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