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SEED-BORNE FUNGI FROM INDIAN SEED LOTS OF *CORIANDRUM SATIVUM* LINN., THEIR SIGNIFICANCE AND CONTROL

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ABSTRACT

Out of 35 fungi associated with 40 seed lots of *Coriandrum sativum*, *Botrytis cinerea*, *Colletotrichum capsici*, *Glomerella cingulata*, *Phoma glomerata*, *Myrothecium* state of *Nectria bactridiodes*, *Periconia atra*, *Coleophoma empetri*, *Epicoccum purpurascens*, *Nigrospora sphaerica*, *Cladosporium sphaerospermum*, Species of *Aspergillus*, *Alternaria*, *Curvularia*, *Drechslera* and *Fusarium* produced varying degrees of seed and seedling mortalities. Dithane M-45 and Thiride 75-D (0.3 per cent) proved most effective in controlling the various seed-borne fungi of coriander.

INTRODUCTION

Seeds of *Coriandrum sativum* Linn. are extensively employed as condimemts in the preparation of curry powder, pickling spices, sausages and seasonings as they are considered to be carminative, stomachic, refrigerant and diuretic. In India, the crop of coriander is cultivated in all the provinces and regarded as an important subsidary crop occupying a substantial acreage in the country. India is one of the major spice growing and exporting countries in the world and about 61 crores worth of spices are exported from India every year (1974-75 spices export promotion report).

A diseased, unhealthy, weak and infected seed gives diseased and poor crop and frustrates the very purpose of growing it. The diseased seeds are the source of transmission of inoculum across the interstate and international boundries and thus need a thorough seed health testing. Although *Alternaria poonensis*, *Colletotrichum capsici*, *Gloeosporium achaeniicola*, *Protomyces macrosporus*, *Erwinia carotovora*, *Pseudomonas* sp., *Xanthomonas carotae* and *Xanthomonas translucens* have been reported to be seed-borne pathogens (Richardson, 1979), an attempt was made to examine the seed-lots of coriander from India by using various methods of seed health testing and to evaluate control measures by applying fungitoxicants and one aquous plant extract.

MATERIAL AND METHODS

Fourty seed samples of coriander were collected from six different states of India varying in their agroclimatic conditions viz., Himachal Pradesh, Panjab, Haryana, Rajasthan, Uttar Pradesh and Madhya Pradesh. The seed samples were stored at 5°C.

As recommended by the International Seed Testing Association Rules

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(ISTA, 1966), the seed samples were examined with the naked eye and under 40x-60x magnification of stereobinocular microscope. 25 cremocarps were shaken on the electrical shaker for 10 minutes in 15 ml of distilled water and later the liquid was centrifuged for 10 minutes. After throwing the supernatant liquid the residue was examined under the compound microscope for associated spores and conidia of various fungi.

400 unsterilized seeds from each sample were tested by 'blotter method'. Three circular white blotter were moistened with 0.02 per cent solution of 2,4-dichlorophenoxy acetic acid to suppress seed germination and the seeds were planted in plastic petriplates of 11 cm diameter. 400 seeds from each lot were surface sterilized with 0.1 per cent mercuric chloride solution for 2-3 minutes and washed 3-4 times with sterilized water, plated on acidified P. D. A. and incubated at 20°±2°C in a chamber provided with alternating cycles of 12 hours light and dark periods. Mycelial fragments were transferred to P. D. A. slants, examined and identified. Single spore isolations were made from these cultures (Srivastava and Gupta, 1981).

Pathogenicity tests were carried out with apparently virulant fungi. For this purpose the seeds from Panipat (Haryana) were used in pathogenicity trials and method of 'contact inoculation' of seeds and examining the growing plants by 'moist blotter' and 'sterilized soil' tests was employed. 200 surface sterilized healthy seeds were rolled on 10-15 days old actively sporulating culture of test fungus. Rolling of seeds on culture was done on a blotting sheet and dried in shade for three days. 100 inoculated seeds were used each for 'moist blotter' and 'sterilized soil' test. 100 seeds inoculated with each test fungus were sown in sterilized garden soil filled in 10 sterilized earthen pots. Observations were recorded on pre and post emergence losses and diseases incidence at later stages of crop growth. 100 surface sterilized uninoculated seeds were kept as control for each test.

For testing the efficacy of certain fungitoxicants in controlling the seed-borne fungi, unsterilized seeds were treated with Agrosan GN, Ceresan dry, Bavistin, Dithane M-45 and Thiride' 75D (0.2 per cent. 0.3 per cent and 0.4 per cent) doses, by weight of 100 dry seeds, for 20 minutes on a mechanical shaker and left in store for 48 hours before incubation (Dharam Vir *et al.*, 1971). The doses of fungicides were prepared on the basis of their active ingredients. A set of untreated seeds served as control. Seeds were also treated with aqueous extract obtained from leaves and flower buds of *Canabis sativus* to determine its efficacy against seed-borne fungi of coriander. This plant grows in abundance in Panipat. The extract was taken by squeezing macerated leaves and flower buds grinding in the mortar. This extract was termed as 100 per cent concentration. Further concentrations were made out of this extract with water. Coriander seeds were dipped in different (50 per cent, 75 per cent and 100 per cent) concentrations of plant extract for 15 minutes and then air dried in shade for 24 hours before sowing on 'moist blotter' (Sheodhan Singh *et al.*, 1979). A suitable control (untreated seeds) was kept.

RESULTS AND DISCUSSION

Inspection of dry seeds by naked eye and under stereobinocular of all the seed samples revealed that the majority of seeds did not show any apparent

sign of infection but a few seeds in many samples exhibited blackish discolouration of their pericarp. In 12 seed lots, a few hypertrophied seeds infected by *Protomyces macrosporus* Ung. were found mixed with normal cremocarps.

The examination of washing residue under compound microscope showed the presence of different spores and conidia of various fungi. Since the types of fungi were similar as detected in the 'blotter test', their description is omitted here. In some samples the chlamydospores of *Protomyces macrosporus* were seen which can not be detected either by 'moist blotter' or 'agar plate' tests.

Data on the seed mycoflora associated with various seed-lots indicate that 35 fungi are associated with seeds of coriander (Table I). These fungi are arranged in an order of decreasing of total percentage of incidence as : *Alternaria alternata, Aspergillus flavus, Phoma glomerata, Cladosporium sphaerospermum, Aspergillus niger, Fusarium semitectum, F. moniliforme, Curvularia lunata, Nigrospora sphaerica, Drechslera hawaiiensis, Drechslera rostrata, Fusarium oxysporum, Penicillium chrysogenum, Curvularia pallescens, Epicoccum purpurascens, Memnoniella echinata, Botrytis cinerea, Stachybotrys atra, Chaetomium globossum, Cephaliophora irregularis, Alternaria tenuissima, Periconia atra, Aspergillus nidulans, Myrothecium* state of *Nectria bactrioides, Curvularia prasadii, Aspergillus sydowii, Aspergillus oryzae, Drechslera spicifera, Coleophoma empetri, Curvularia verruculosa,Alternaria porri, Colletotrichum capsici, Glomerella cingulata, Penicillium crustosum* and *Ulocladium consortiale*. The other fungi not recorded in the table due to their insignificant percentage of incidence, are *Mucor* sp., *Rhizopus* spp., a *Penicillium* sp. and two *Aspergillus* spp. These fungi did not appear on P. D. A. also.

In 'agar plate' method the surface sterilized seeds yielded 29 fungi in their low percentage of incidence as compared to 'moist blotter'. Fungi like *Aspergillus sydowii, Penicillium crustosum, Chaetomium globosum, Memnoniella echinata, Stachybotrus atra* and *Ulocladium consortial* did not appear in the 'agar plate' method.

In pathogenicity trials viz., 'moist blotter' and 'sterilized soil' tests almost all the pathogens tested reduced seed germinability by inducing seed and seedling mortalities. *Colletotrichum capsici, Glomerella cingulata, Botrytis cinerea, Phoma glomerata, Curvularia lunata, Myrothecium* state of *Nectria bactridioides* and all the species of *Alternaria*, and *Fusarium* proved to be 'very severe' seed-borne pathogens because they caused 65-85 per cent seed and seedling mortalities. *Aspergillus flavus, A. niger, Curvularia prasadii, Curvularia verruculosa, Periconia atra* and *Drechslera* spp. produced 40-60 per cent seed and seedling mortalities and were proved to be 'severe' seed-borne pathogens. *Aspergillus oryzae, Cladosporium sphaerospermum, Coleophoma empetri, Epicoccum purpurascens* and *Nigrospora sphaerica* proved to be 'mild' pathogens which caused 20-25 per cent seed and seedling mortalities. Similar types of seed and seedling mortalities produced by seed mycoflora are reported by Aulakh *et al.*, 1976, Kumar and Nema, 1974, Pangtey *et al.*, 1982, Singh and Chohan, 1973 and Srivastava and Gupta, 1980, 1982.

The fungitoxicants used for seed treatments, Dithane M-45 and Thiride 75-D(0.3 per cent) eliminated almost all the fungi associated with seeds of coriander besides improving the seed germinability. Bavistin (0.4 per cent) also gave complete control of all the seed-borne fungi except *Alternaria alternata* which developed on a very few seeds. Fungi

TABLE I

SEED-BORNE FUNGI OF *CORIANDRUM SATIVUM* LINN.
(observations based on 400 seeds)

Fungi	Maximum percentage of incidence		Number of seed-lots with which the fungus was associated (out of 40)
	Untreated seeds incubated on 'moist blotter'	Pretreated seeds incubated on acidified PDA.	
1. *Aspergillus flavus*	28.75	10.25	36
2. *A. nidulans*	7.5	4.75	7
3. *A. niger*	26.75	9.25	18
4. *A. oryzae*	5.5	3.0	6
5. *A. sydowii*	6.25	—	5
6. *Penicillium chrysogenum*	6.0	3.75	10
7. *P. crustosum*	3.75	—	3
8. *Alternaria alternata*	72.75	36.75	40
9. *A. porri*	4.25	2.5	4
10. *A. tenuissima*	7.75	5.25	7
11. *Botrytis cinerea*	10.0	6.75	8
12. *Cephaliophora irregularis*	9.75	5.75	8
13. *Chaetomium globosum*	11.25	—	9
14. *Cladosporium sphaerospermum*	20.75	9.75	35
15. *Coleophoma empetri*	4.5	2.75	6
16. *Colletotrichum capsici*	4.0	2.5	6
17. *Curvularia lunata*	8.5	5.5	26
18. *C. pallescens*	6.5	4.25	10
19. *C. prasadii*	4.75	2.75	5
20. *C. verruculosa*	4.0	2.75	5
21. *Drechslera hawaiiensis*	9.75	5.75	21
22. *D. rostrata*	5.75	3.75	16
23. *D. spicifera*	5.0	2.75	6
24. *Epicoccum purpurascens*	7.25	4.5	12
25. *Fusarium moniliforme*	16.25	9.25	25
26. *F. oxysporum*	7.0	4.0	17
27. *F. semitectum*	18.75	9.5	31
28. *Glomerella cingulata*	3.75	2.0	7
29. *Memnoniella echinata*	8.5	—	16
30. *Myrothecium* state of *Nectria bactridioides*	6.75	4.0	8
31. *Nigrosppra sphaerica*	12.75	7.0	18
32. *Periconia atra*	7.0	3.75	10
33. *Phoma glomerata*	27.5	9.75	20
34. *Stachybotrys atra*	4.0	—	21
35. *Ulocladium consortiale*	3.25	—	5

like, *Alternaria alternata*, *Aspergillus flavus* and *Curvularia lunata* were observed in a very low count in the seeds treated with Ceresan dry (0.4 per cent). Dithane M-45 has also been found very effective in controlling the seed-borne fungi of rice (Dharam Vir *et al.*, 1971) and barley (Rai and Singh, 1976).

The seed treatment with aqueous extract (100 per cent) of a *Canabis sativus* was found very effective in controlling the seed-borne fungi of coriander. However, this treatment suppressed the seed-germination completely and even its low concentrations did not allow the seeds to germinate thus defeating the very purpose.

It is evident from these studies that the seeds of coriander carry several fungi which may result in different levels of seed and seedling mortalities under field conditions. It is, therefore, advisable to use pretreated seeds for sowing purposes.

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