

Full Length Research Paper

Incidence of mycoflora from the seeds of Indian main spices

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India, despite being the largest producer of spices, there is great potential for increasing export of Indian spices. To realize this potential there must be improvement and enhancement of productivity and quality. As per international standards, India does not export more than 10% of its production due to the followings: lack of a number of improved seed varieties that suit different agro-climatic situations and proper adoption of package practices, lack of control measures for diseases, pests and post harvest pathogens. Pathogens adversely affect production and quality of spices. The seed-borne pathogens are one of the major causes of serious diseases in growing crops because of poor health and quality of seeds. To realize this aspect, the study has been undertaken and it is observed that among the tested spices, *Alternaria alternata*, *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus ustus*, *Cladosporium cladosporidies*, *Curvularia lunata*, *Fusarium oxysporum*, *Fusarium roseum*, *Helminthosporium tetramera*, *Trichoderma viride* show maximum incidence on Agar plate and *A. alternata*, *A. flavus*, *A. niger*, *A. ustus* and *H. tetramera* have maximum incidence on Blotter plate.

Key words: Spices, incidence, fungi.

INTRODUCTION

Spices are cultivated in different parts of the world; however, India is the largest spice producing country in the world. About 63 plants spices are cultivated in the country, among which most are traded nationally and internationally. In India the spices are cultivated in Tamil Nadu, Kerala, Andra Pradesh, Karnataka, Rajasthan, Gujrat, Madhy Pradesh, Uttar Pradesh, Punjab, Kashmir etc. based on different agroclimatic conditions (Divakar and Sharma, 2001). Seeds play vital role in the transmission of pathogen and development of disease. The pathogen may be externally or internally seed borne. This takes place either in the field or in poor storage condition, and results in the development of disease at later stages of plant growth by systemic or local infections (Tribhuvan and Trivedi, 2000). Such contaminated seeds cause serious diseases in human beings (Ragab and El- Syied,

1998). Literature on seed of mycoflora spices was revealed and observed by several workers. Manjari and Jariwala (1996) assessed mycoflora spices collected from local markets of Varnasi after 12 months of storage in metallic containers and isolated 39 and 24 fungal species from un-sterilized and surface sterilized stored seeds respectively. Seema (2003) isolated 168 isolates of *Aspergillus flavus* from 14 spices including ammi and cardamom. Ayres et al. (1980) stated *Aspergillus* and *Penicillium* spp. as dominant among spices including cardamom. The contamination of cardamom by fungi was reported by Lebai et al. (1985).

Regina and Raman (1988) reported 21 fungal spices of caraway. Gordana et al. (2008) reported 11 genera and 23 species, where *Aspergillus* and *Penicillium* species were dominant contaminants of caraway. Prasad (1996) reported infestation of *Aspergillus flavus*, *Aspergillus nidulans*, *Curvularia lunata*, *Curvularia pallescens*, *Cladosporium cladosporidies*, *Cladosporium oxysporium* and *Memnoniella echinata* in pre-storage stage of coriander and observed increase in values after 6

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Table 1. Incidence of fungi on different spices on agar plate.

Fungi	% Incidence (Prevalence)				
	Ammi	Caraway	Cardamom	Coriander	Cumin
<i>Alternaria alternata</i>	30	20	10	20	30
<i>Alternaria tetramera</i>	10	--	20	--	--
<i>Aspergillus flavus</i>	40	20	20	30	20
<i>Aspergillus glaucus</i>	20	20	--	10	--
<i>Aspergillus niger</i>	20	30	20	40	30
<i>Aspergillus rubrer</i>	--	---	10	20	--
<i>Aspergillus ustus</i>	30	20	20	--	20
<i>Botrytis cineria</i>	10	--	--	10	20
<i>Cladosporium cladosporidies</i>	20	20	30	30	--
<i>Curvularia lunata</i>	30	--	30	--	20
<i>Curvularia tetramera</i>	--	20	--	10	--
<i>Fusarium dimerum</i>	10	--	10	--	--
<i>Fusarium equiseti</i>	--	--	20	--	--
<i>Fusarium moniliforme</i>	20	30	--	--	20
<i>Fusarium oxysporum</i>	30	40	--	10	--
<i>Fusarium roseum</i>	--	--	--	10	10
<i>Helminthosporium tetramera</i>	30	40	20	20	30
<i>Macrophomina phaseolina</i>	--	--	--	15	--
<i>Penicillium chrysogenum</i>	--	--	20	--	--
<i>Rhizoctonia bataticola</i>	--	10	--	10	--
<i>Trichoderma viride</i>	20	--	--	20	30
<i>Tubercularia vulgaris</i>	20	20	10	--	10
<i>Verticillium notatum</i>	--	--	--	10	--

months. Rani et al. (1995) studied mycoflora seed of 5 spices including coriander, in which species of *Alternaria*, *Curvularia*, *Aspergillus*, *Rhizopus* and *Mucor* sps. were most common. Jain and Jain (1995) isolated 32 fungal species from 4 spice crops including coriander where *Alternaria alternata* was found dominant. Hashmi and Ghaffar (1991) collected seed borne mycoflora of coriander from seed samples of 15 countries and isolated 24 fungal species belonging to 14 genera such as *Alternaria alternata*, *Fusarium moniliforme*, *Phoma* spices, *Fusarium semitectum*, *Fusarium solani*, *Fusarium eqiseti* etc. Rastogi (1993) found *Alternaria burnsii* to be a contaminant of black coloured seeds of cumin; this was seen in 47 samples out of 105 samples from 16 districts of Rajasthan in blotter and agar plate technique. Gamal et al. (1990) isolated 13 fungi in healthy as well as infected seed samples of cumin collected from six locations of Upper Egypt, where *Fusarium oxysporum* sp. cumini, *Fusarium solani* and *Alternaria alternata* were observed in higher percentages.

MATERIALS AND METHODS

Collection of samples and detection of seed mycoflora

In collection of seed samples, the method described by Neergaard

(1973) has been adopted. Accordingly, random samples of different varieties of seeds were collected from fields, store houses market places and seed companies. A composite sample of each variety was prepared by mixing the individual samples together and the seed mycoflora was isolated by using standard moist blotter method (SMB) and agar plate method (APM) as recommended by ISTA (1966) and Neergaard (1973 and 1977). The identification of seed mycoflora was done as per the method of Bessey (1950), Tempe (1970), Agarwal (1976), Dube (1990), Mukadam (1997) and Mukadam et al. (2006).

RESULTS

In order to know the percent incidence of seed mycoflora of five different spices, commonly cultivated in India, the 23 virulent fungal species were isolated by agar plate method from the test seeds of spices. The data given in Table 1 reveal that the first order of infection (40%) is observed by *Aspergillus flavus*, *Aspergillus niger* in ammi and coriander respectively followed by *Fusarium oxysporum* and *Helminthosporium tetramera* in caraway. The second order of infection (30%) of *Alternaria alternata* and *Helminthosporium tetramera* was respectively observed on ammi and cumin; *Cladosporium cladosporidies* on cardamom and coriander; and similar observations were made by *Aspergillus flavus*, *A. ustus*, *Fusarium moniliforme* and *Trichoderma viride* on

Table 2. Incidence of fungi on different spices on blotter paper

Fungi	Ammi	Caraway	Cardamom	Coriander	Cumin
	% incidence				
<i>Alternaria alternata</i>	20	15	--	20	20
<i>Alternaria tetramera</i>	--	--	10	--	--
<i>Aspergillus flavus</i>	30	20	10	10	20
<i>Aspergillus fumigatus</i>	--	--	--	--	10
<i>Aspergillus niger</i>	20	20	10	20	10
<i>Aspergillus rubrer</i>	--	--	--	10	--
<i>Aspergillus ustus</i>	20	10	20	--	--
<i>Botrytis cineria</i>	--	--	--	10	--
<i>Cladosporium cladosporidies</i>	--	10	--	--	10
<i>Curvularia lunata</i>	10	10	--	10	--
<i>Curvularia tetramera</i>	--	--	10	--	--
<i>Fusarium moniliforme</i>	10	10	--	--	10
<i>Fusarium oxysporum</i>	--	--	10	--	10
<i>Fusarium roseum</i>	--	10	--	10	--
<i>Helminthosporium tetramera</i>	20	20	--	10	--
<i>Trichoderma viride</i>	--	--	--	10	--
<i>Verticillium notatum</i>	10	--	10	--	--

coriander, ammi caraway and cumin respectively. Furthermore, it is interesting to note that *Alternaria tetramera*, *Fusarium dimerum*, *Fusarium equiseti*, *Rhizoctonia bataticola* and *Verticillium notatum* show low degree of infections.

Seventeen different fungal species were isolates from blotter paper method from the test seeds of spices. As per data of Table 2, *Aspergillus flavus* is observed as most infectious fungus, that is 30% of incidence on ammi followed by *Alternaria alternata*, *Aspergillus niger*, *A. ustus* and *Helminthosporium tetramera*. The individual incidences of *Alternaria tetramera*, *Aspergillus fumigatus*, *A. rubrer*, *Botrytis cineria*, *Curvularia tetramera* and *Trichoderma viride* were found lowest (10%) on spices.

DISCUSSION

Many developing countries have been trying to increase the quality of their seed production. Unfortunately due to the lack of proper post harvest preservation techniques, large portion of annual yield gets damaged by fungal action according to Durakovic and Durakovic (2003), Seema and Basu (2003), Abou (2008) and Dimic et al. (2008).

Twenty three different fungi were isolated from the test spices. It indicates the ability of fungi in developing association with broad spectrum of seeds, irrespective of their types. The similar reports regarding the incidence of fungi have been given by Sharma and Sharma (1984) and Regina and Raman (1992) in Ammi and cumin, and *A. niger*, *A. flavus*, *A. fumigatus*, and *Cladosporium herbarum* have been recorded as most dominant. Agar

plate method is proved to be superior for the highest incidence of fungi and the results are similar to the reports of Bilgrami and Ghaffar (1993) and Motta et al. (1996).

The highest incidence of fungi was observed in ammi and coriander followed by cardamom, caraway and cumin respectively according to Seema and Monica (2003). It is interesting to note that the species of *A. alternata*, *A. flavus*, *A. niger*, *C. cladosporidies*, *Curvularia lunata*, *F. oxysporum* and *H. tetramera* have dominant association, a similar results also reported by Ayres et al. (1980). The overall result reveals that the agar method is a more supporting medium than blotter method used for the isolation of 23 fungi versus 17 fungi isolated.

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