

FUNGI ASSOCIATED WITH SEEDS OF SUNFLOWER (*HELIANTHUS ANNUUS* L.) GROWN IN RAJASTHAN AND THEIR PHYTOPATHOLOGICAL EFFECTS

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One hundred eighty eight seed samples of sunflower (*Helianthus annuus* L.) from 11 districts of Rajasthan revealed saprophytic as well as parasitic fungi belonging to 43 species of 23 genera. *Alternaria alternata*, *Aspergillus flavus*, *A. niger*, *Curvularia lunata*, *Drechslera tetramera*, *Fusarium moniliforme*, *F. oxysporum*, *Rhizoctonia bataticola*, *Rhizopus nigricans* and *Trichothecium roseum* were the dominating pathogenic fungi which caused seed germination losses and seedling symptoms.

Keywords : Phytopathological effects; Seed-borne fungi; Sunflower.

Introduction

Sunflower (*Helianthus annuus* L.) is an important oil seed crop of the world. In India, it was introduced in the year 1969. The major crop growing states are Maharashtra, Karnataka and Tamilnadu. In Rajasthan, the crop was grown under 15,340 ha area with an annual production of 12,300 tonnes in the year 1994. Seeds of sunflower are known to harbour a large number of fungi^{1,2}. In India, fungi associated with sunflower seeds have been reported from Uttar Pradesh³, Andhra Pradesh^{4,5}, Madras⁶, Maharashtra⁷ and Haryana⁸. In Rajasthan, Jhamaria *et al*⁹. isolated 7 fungi on sunflower seeds. Since, no study gives systematic and comprehensive data on fungi associated with sunflower seeds grown in Rajasthan, the present investigation was under taken.

Materials and Methods

One hundred eighty eight seed samples of sunflower from 11 districts of Rajasthan were collected from farmers fields (crop seasons 1992-94). These were subjected to dry seed examination (400 seeds/samples) and incubated by blotter test¹⁰. 69 samples studied using potato dextrose agar (PDA) plate test¹⁰.

The phytopathological effects of fungi on seed germination and seedlings were also studied in the incubation tests.

Results and Discussion

Dry seed examination : On the exomorphic features in dry seed inspection, the seeds were categorised into (I) bold-symptomless seeds (12.25-89.0%), (II) bold-discoloured seeds (9.0-71.75%) and (III) shrivelled-discoloured seeds (1.0-30.75%). Seeds with greyish-brown and brown to black discolourations on incubation yielded species of *Alternaria*, *Aspergillus* and *Curvularia*. Seeds with blackish spots on their surface yielded *Rhizoctonia bataticola*.

Incubation tests : A total of 43 and 16 fungal species belonging to 23 and 14 genera, saprophytic as well as pathogenic, were isolated on sunflower seeds in blotter and PDA tests respectively. Among the pathogenic fungi *Alternaria alternata* (1-95%), *Cladosporium cladospriedes* (1-88%), *Chaetomium indicum* (1-9%), *Curvularia lunata* (1-43), *Drechslera tetramera* (1-7), *Fusarium moniliforme* (1-39%), *F. oxysporum* (1-26%), *Myrothecium roridum* (1-21%), *Rhizopus nigricans* (1-100%), *Rhizoctonia*

Table 1. Number of seed samples of sunflower infected with fungi and their percentage range of incidence in incubation tests (188 seed samples studied).

| Fungi | Blotter Test | | | | PDA Test | |
|-------------------------------------|------------------|---------|------------------|---------|------------------|---------|
| | Untreated seeds | | Pretreated seeds | | Samples infected | % Range |
| | Samples infected | % Range | Samples infected | % Range | | |
| <i>Actinomucor</i> sp. | 79 | 4-98 | 25 | 1-18 | 7 | 1-5 |
| <i>Alternaria alternata</i> | 130 | 1-95 | 133 | 1-98 | 48 | 1-100 |
| <i>Alternaria helianthi</i> | 4 | 1-12 | 4 | 1-16 | - | - |
| <i>Aspergillus candidus</i> | 28 | 1-92 | 4 | 1-13 | - | - |
| <i>A. flavus</i> | 145 | 1-98 | 51 | 1-53 | 12 | 1-25 |
| <i>A. funigatus</i> | 80 | 1-87 | 25 | 1-19 | - | - |
| <i>A. niger</i> | 121 | 1-98 | 37 | 1-57 | 7 | 1-28 |
| <i>Chaetomium indicum</i> | 15 | 1-9 | 33 | 1-18 | 5 | 1-8 |
| <i>Cladosporium cladosporioides</i> | 82 | 1-88 | 44 | 1-45 | 8 | 1-9 |
| <i>Curvularia lunata</i> | 81 | 1-43 | 76 | 1-29 | 19 | 1-21 |
| <i>Drechslera tetramera</i> | 23 | 1-7 | 29 | 1-16 | 5 | 1-12 |
| <i>Fusarium moniliforme</i> | 59 | 1-39 | 46 | 1-18 | 19 | 1-23 |
| <i>F. oxysporum</i> | 74 | 1-26 | 58 | 1-27 | 22 | 1-31 |
| <i>Macrophomina phaseolina</i> | 7 | 1-5 | 18 | 1-10 | - | - |
| <i>Memnoneilla echinata</i> | 39 | 1-47 | 23 | 1-25 | 4 | 1-4 |
| <i>Myrothecium roridum</i> | 37 | 1-21 | 32 | 1-16 | - | - |
| <i>Rhizoctonia bataticola</i> | 61 | 1-33 | 71 | 1-40 | 27 | 3-55 |
| <i>Rhizopus nigricans</i> | 145 | 1-100 | 36 | 1-46 | 19 | 1-31 |
| <i>Trichothecium roseum</i> | 99 | 1-57 | 41 | 1-35 | 17 | 1-31 |

Other fungi: *Alternaria longissima*, *A. radicina*, *A. raphani*, *Aspergillus nidulans*, *A. sulphureus*, *A. wentii*, *Chaetomium globosum*, *Chaetomium* sp., *Colletotrichum dematium*, *Curvularia affinis*, *C. pallescens*, *C. robusta*, *Drechslera avenacea*, *D. halodes*, *D. maydis*, *D. papendorffii*, *Fusareilla indicra*, *Melanospora zamiae*, *Penicillium* spp., *Pacelomyces* spp., *Stachybotrys atra*, *Streptomyces* spp and *Verticillium albo-atrum*.

bataticola (1-33%) and *Trichothecium roridum* (1-57%) were dominant (Table 1). The saprophytic fungi showing high incidence were *Actinomucor* sp. (4-98%), *Aspergillus flavus* (1-98%), *A. fumigatus* (1-87%), *A. niger* (1-98%) and *Memnoneilla echinata* (1-47%) (Table 1). Chlorine pretreatment reduced the percentage of saprophytes and promoted seed germination. In PDA method, all the fungi recorded were common to the incubation test and *Alternaria alternata*, *Colletotrichum dematium*, *Fusarium moniliforme*, *F. oxysporum*, *Rhizoctonia bataticola* and *Verticillium albo-atrum* were detected in high percentages as compared to blotter test (Table 1).

A general assessment of the total seed-borne inoculum revealed that seed samples of Alwar, Baran, Chittorgarh, Jaipur, Jhalawar, Kota and Sri Ganganagar mostly showed heavy inoculum and greater incidence of fungi. This may be due to more reverine areas and with more rainfall hence high humidity is in general which favours the sporulation of the fungus.

Phytopathological effects : The major fungi hampering seed germination and causing high seedling mortality in the present study were *Alternaria alternata*, *Aspergillus flavus*, *A. niger*, *Curvularia lunata*, *Drechslera teramera*, *Fusarium moniliforme*, *F. oxysporum*, *Rhizoctonia bataticola*, *Rhizopus nigricans* and *Trichothecium roseum*. Similar observations have been made by Jhamaria *et al*⁹ and Raut¹¹ who reported approximately 20-30% reduction in germination due to seed-borne fungi.

Alternaria alternata, *Aspergillus flavus*, *Curvularia lunata*, *Fusarium moniliforme*, *F. oxysporum*, *Rhizoctonia bataticola* and *Trichothecium roseum* caused

seedling symptoms of browning and spots on cotyledonary leaves, hypocotyl and root-shoot transition zone. Similar observations were made by Chandra *et al*¹² and Mahajan and More⁷.

The present study has revealed that the sunflower seeds from Rajasthan carry a heavy load of inoculum of pathogenic as well as saprophytic fungi, causing seed germination losses and seedling symptoms and should be checked in seed lots in routine seed health testing.

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