

SEED-BORNE FUNGI OF SOME TROPICAL ORNAMENTAL PLANTS

B.R. Dayakar Yadav* and V.G. Rao**

SUMMARY

The paper describes and illustrates seed-borne fungi of 23 tropical commercial ornamental plant seeds collected from different sources for a period of 3 years. Both blotter test and agar plate test were conducted to study both external and internal fungi of seeds and other floral parts. The seeds of the 23 plants studied were carrying various fungi.

The distribution and types of various fungi encountered in these studies are discussed.

KEY-WORDS: Seed-borne fungi; ornamental plants.

RESUMO

Fungos de sementes de algumas plantas ornamentais de clima tropical.

O trabalho descreve e ilustra fungos de sementes de 23 plantas ornamentais econômicas de clima tropical, coletadas de diferentes locais durante três anos. Testes de sanidade pelos métodos de papel de filtro ("blotter-method") e cultivo em agar ("agar plating") foram conduzidos para estudar fungos localizados interna e externamente nas sementes e outras partes florais. As sementes das 23 plantas estudadas veiculavam fungos. A distribuição e as espécies de fungos encontrados nesses estudos são discutidas.

PALAVRAS-CHAVE: Fungos de sementes; plantas ornamentais.

INTRODUCTION – The objective of this study was to investigate various aspects of stored seed samples of ornamental plants carrying fungal infections, and their inoculum components like conidia, sclerotia, chlamydospores, dormant mycelium fragments etc. The seed material included in the present study was of economic significance, since such ornamental plants are grown on a large scale for commercial purposes. From the literature it showed that the seed-borne fungi of many ornamental plants are not fully investigated, especially from the tropics (1, 2, 6, 16, 17). NEERGAARD, in a 1977 survey (14), pointed out that very few seed-borne pathogens could be detected in arid or semi-arid regions, but that these are present abundantly in rainy seasons or areas. Those fungi that are frequently found on seeds of ornamental plants are in their imperfect state, rarely in perfect state.

MATERIAL AND METHODS – In the present study 23 seed samples have been screened for seed-borne fungi. In all cases, random sample of 100 seeds were picked from each

seed sample and equally distributed into four replicates (each with 25 seeds). The seed samples were collected from the university ornamental garden stores and the local seed suppliers in small quantities (25 g), in separate polythene bags. The most commonly used techniques for the detection of seed-borne fungi were adopted: a) Blotter test (BT) (7) and b) Agar plate test (APT) (12, 13, 15). In BT method seeds were incubated on a moist blotter paper (Whatman No. 42) at 24°C and observed after 48 hours thereon. In case of APT seeds were surface sterilized with 0.01 percent mercuric chloride for 1 minute, washed with sterilized distilled water and were placed on potato dextrose agar (PDA) media and incubated at 24°C. All samples were examined by stereo zoom binocular microscope (Bausch and Lomb-7x-30x) for top growth and pycnidial structures etc. on seeds and photomicrographs were taken.

RESULTS AND DISCUSSION – The mycoflora of seeds, particularly the phytopathogenic composition types of fungi and distribution has been studied and the results obtained

* Scientific Officer-I (Plant Protection), Karnataka State Sericulture Development Institute, Bangalore-560 062, India.

** Scientist-"C", Department of Mycology and Plant Pathology, MACS Research Institute, Poona-411 004, India.

FIG. A

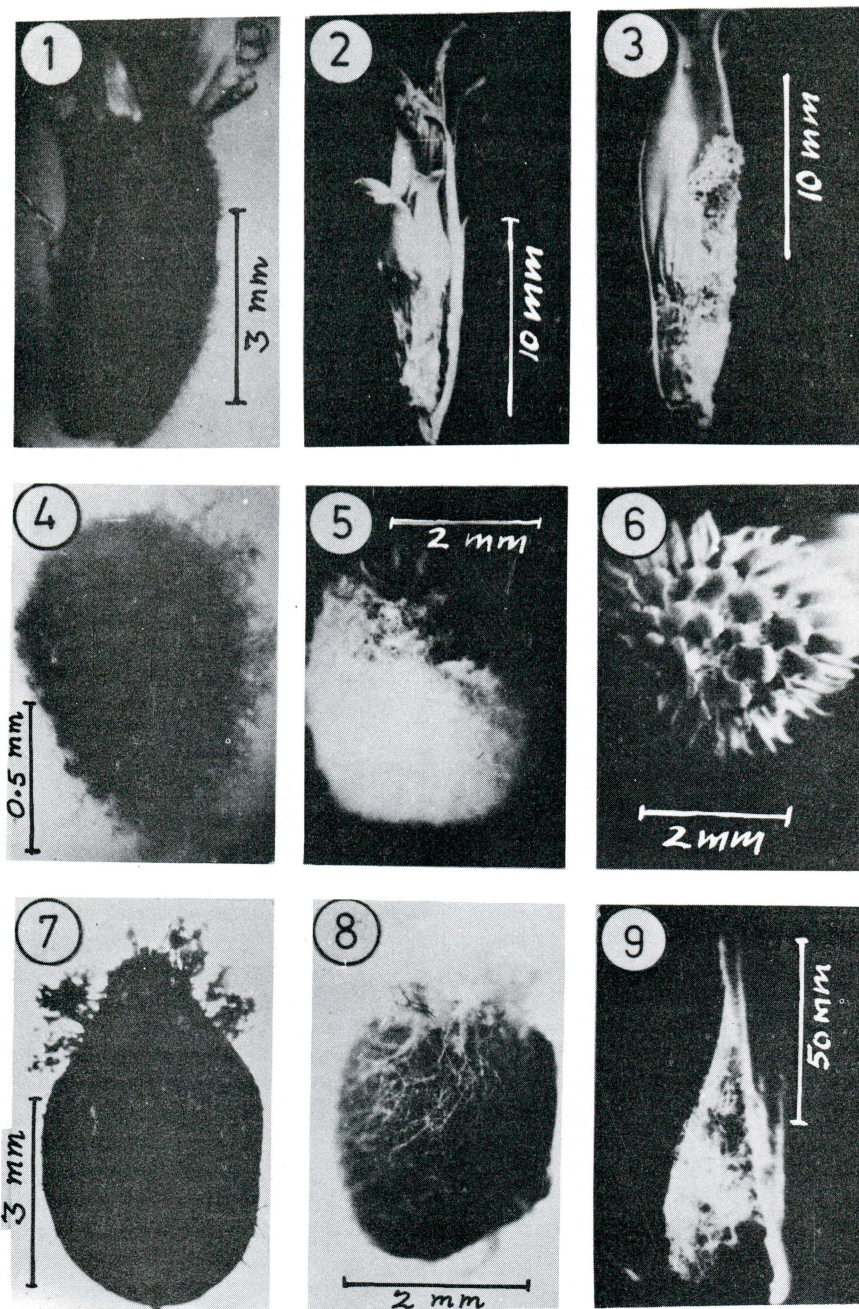


FIGURE A — Seed-borne fungi photomicrographed from blotter test method.

1. *Alternaria dianthicola* on *Calendula officinalis* seed.
- 2 - 3. *Fusarium oxysporum* on *Dianthus caryophyllus* ovary.
4. *Alternaria dianthicola* on *Antirrhinum majus* seed.
5. *Fusarium oxysporum* on *Crossandra infundibuliformis* seed.
6. Normal seed of *Crossandra infundibuliformis*.
7. *Curvularia lunata* on *Salvia officinalis* seed.
8. Mycelia mat of *Alternaria* sp. on *Salvia officinalis* seed.
9. *Fusarium oxysporum* on *Tagetes erecta* seed.

FIG. B

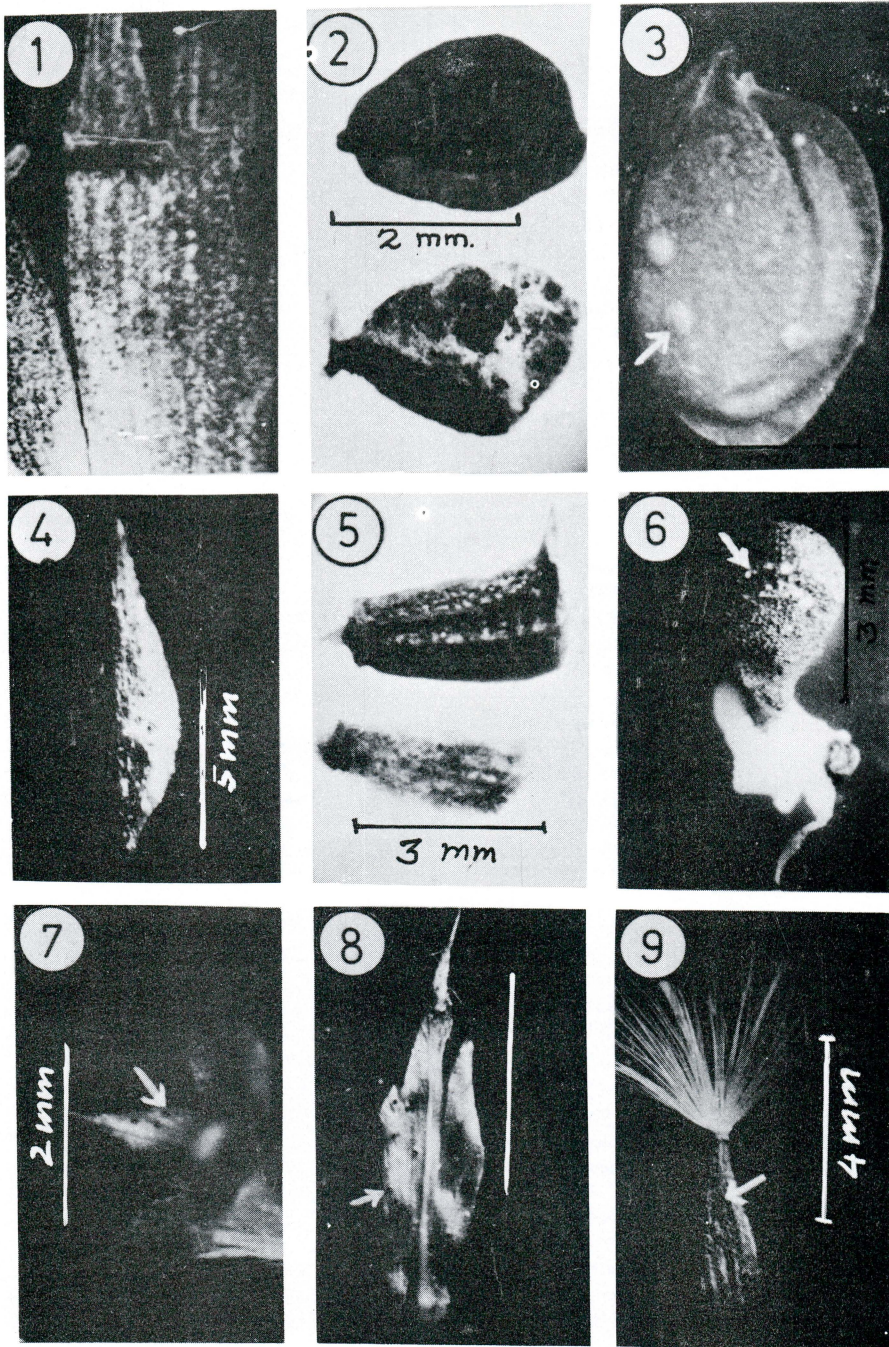


FIGURE B — Seed-borne fungi photomicrographed from blotter test method.

1. *Alternaria dianthi* on *Dianthus caryophyllus* corola.
2. *Fusarium oxysporum* on *Dianthus caryophyllus* seed (normal seed above).
3. Pycnidial structure on *Ebenus umbellata* seed.
4. *Fusarium oxysporum* on *Gerbera jamesonni* seed.
5. *Alternaria zinniae* on *Chrysanthemum indicum* seed.
6. *Fusarium oxysporum* on *Impatiens balsamina* seed.
7. Pycnidial bodies on *Gaillardia pulchella* seed appendage.
8. *Phoma exigua* on *Crossandra infundibuliformis* bracts.

TABLE 1 — External and internal seed-borne fungi of some tropical ornamental plants detected by the blotter and agar plate methods.

Ornamental plants	Mycoflora of seeds and floral parts	
	Blotter test method	Agar plate test (of sterilized seeds)
<i>Antirrhinum majus</i> L.	<i>Alternaria dianthicola</i> Neerg. (18%)	—
<i>Calendula officinalis</i> L.	<i>A. dianthicola</i> Neerg. (20%)	—
<i>Callistephus chinensis</i> Nees.	<i>Alternaria tenuis</i> Nees. (> 21%)	—
<i>Celosia cristata</i> L.	<i>Fusarium oxysporum</i> Schl. ex Fr. (7%)	<i>Chaetomium globosum</i> Kunze & Schum.
<i>Centaurea cyanas</i> L.	<i>Alternaria tenuis</i> Nees. (21%)	—
<i>Chrysanthemum indicum</i> L.	<i>Alternaria zinniae</i> Pape. (< 16%)	—
<i>Crossandra infundibuliformis</i> (L.) Nees.	<i>Fusarium oxysporum</i> Schl. x Fr. (12%)	—
<i>Delphinium ajacis</i> L.	<i>Phoma exigua</i> Desm.*	
	<i>Alternaria tenuis</i> Nees. (11%)	—
	<i>Alternaria chrysanthemi</i> Simmons & Crossier. (2%)	—
	<i>Pithomyces Karoo</i>	—
	Marassus & Schumann. (< 1%)	—
<i>Dianthus caryophyllus</i> L.	<i>Curvularia lunata</i> (Wakker) Boedijn (< 12%)	—
	<i>Alternaria dianthi</i> Schl. ex Fr.*	—
	<i>Fusarium oxysporum</i> Schl. ex Fr.	—
<i>Ebenus umbellata</i> L.		<i>Fusarium oxysporum</i> Schl. ex Fr. (2%)
	<i>Alternaria tenuis</i> Nees. (16%)	
	<i>Alternaria gomphrenae</i> Togashi. (2%)	—
<i>Gaillardia pulchella</i> Foug.	<i>Alternaria tenuis</i> Nees. (Fr.) Keissler. (21%)	<i>Phoma exigua</i> Desm.*
<i>Gerbera jamesonii</i> Bolus	<i>Colletotrichum gloeosporioides</i> (Penz) Sacc. (7%)	<i>Colletotrichum gloeosporioides</i> (Penz.) Sacc.
	<i>Fusarium oxysporum</i> Schl. ex Fr. (11%)	
	<i>Fusarium concolor</i> Reinking (10%)	<i>Phytophthora palmivora</i> Butler.
<i>Helianthus annuum</i> L.	<i>Alternaria zinniae</i> Pape. (> 18%)	—
<i>Impatiens balsamina</i> L.	<i>Fusarium oxysporum</i> Schl. ex Fr. (11%)	—
<i>Ipomoea variegata</i>	—	<i>Cercospora ipomoeae</i> (9%)
<i>Petunia violacea</i> Lindl.	<i>Phoma pomorum</i> Thum.*	—
<i>Phlox drumondii</i> Hook.	<i>Alternaria tenuis</i> Ness. (18%)	—
	<i>Cladosporium tenuis</i> Nees. (8%)	—
<i>Salvia coccinea</i> Juss.	<i>Alternaria tenuis</i> Nees. (14%)	<i>Cladosporium oxysporum</i> Berk & Curt.
	<i>Fusarium oxysporum</i> Schl. ex Fr. (7%)	
<i>Salvia officinalis</i> L.	<i>Alternaria tenuis</i> Nees. (4%)	—
	<i>Curvularia lunata</i> (Wakker) Boedijn. (9%)	—
	<i>Fusarium oxysporum</i> Schl. ex Fr. (5%)	—
<i>Saponaria officinalis</i> L.	<i>Alternaria dianthi</i> Stevens & Hall. (7%)	—
<i>Spilanthes achmella</i> Murr.	<i>Alternaria tenuis</i> Nees. (9%)	—
<i>Tagetes erecta</i> L.	<i>Alternaria zinniae</i> Pape. (14%)	—
	<i>Curvularia lunata</i> (Wakker) Boedijn (4%)	—
	<i>Fusarium oxysporum</i> Schl. ex Fr. (6%)	<i>Fusarium oxysporum</i> Schl. ex Fr.
<i>Zinnia linearis</i> L.	<i>Alternaria zinniae</i> Pape. (> 8%)	—

* Fungi occurring on floral parts.

ned thereon are presented (Tab. 1 and Fig. A-B). The 23 ornamental plant seeds studied were found to be contaminated with various fungi. Among these, in plants like *Calendula officinalis* L. and *Gerbera jamesonii* Bolus, seeds were completely deteriorated with *Alternaria dianthicola* Neerg. (8, 16) and *Fusarium concolor* Reinking. (= *F. roseum*, Link) (4,5) respectively (Fig. A-1 and Fig. B-4).

Seeds contamination due to species of *Alternaria dianthicola*, *Alternaria tenuis* Nees., *Alternaria zinniae* Pape. and *Fusarium oxysporum* Schl. ex Fr. was found to be of common occurrence on many seeds (Fig. A-2 to 5,9 and Fig. B-2) with percentage ranging from 4 to 21. Pre-emergence damping-off of seedlings in case of *Impatiens balsamina* L. was due to *Fusarium oxysporum* which at first appeared on the seed coat (Fig. B-6), but complete invasion by the pathogen occurred after germination, and resulted in wilting of the seedlings. The other interesting observation was that of *Curvularia lunata* (Wakker) Boedijn. infection (Fig. A-7); this fungus was highly pathogenic to the seedlings of *Salvia officinalis* and *Delphinium ajacis* L., which developed typical damping-off within 4-5 days of germination. Other fungi encountered were *Phoma glomerata* (Corda) W & H (Fig. B-9), *Phoma exigua* Desm. (Fig. B-8) and *Colletotrichum gloeosporioides* (Penz) Sacc.

With agar plate test direct isolation was resorted to by planting the seeds on PDA. This was made to recover any other fungi being associated and not developed on wet blotter paper. The surface sterilized seeds were mostly free from many of the commonly associated molds. Further, the seeds carrying fungi at sub layers readily germinated and showed infection, especially by forms like *Fusarium oxysporum* on *Ebenus umbellata* L., *Colletotrichum gloeosporioides* and *Phytophthora palmivora* Butler. on *Gerbera jamesonii* and *Phoma exigua* on *Gaillardia pulchella* Foug., which firmly adhere to the seed coat and remained 'in-situ' even after repeated mild washing with sterilized distilled water. Apart from these, the floral parts like ovary, corolla, bracts and seed appendages also carried fungi (Fig. A-2,3 Fig. B-1, 7, 8). The surface sterilized seeds on agar plate test did show the seed-borne nature of a few fungi (Tab. 1). Further study showed that some of the fungi which were associated with the seed material and appendages are also responsible for inciting diseases on the foliage, flowers, twigs and branches (3, 6, 16).

ACKNOWLEDGEMENT

The authors are grateful to Dr. Paul Neergard, Director, Danish Government, Institute of Seed Pathology for Developing Countries, Denmark, for the suggestions during the preparation of the manuscript. The senior author acknowledges Department of Science & Technology (Govt. of India) for providing financial assistance. The present paper is a part of the Ph.D. thesis submitted to University of Poona.

REFERENCES

1. BAKER, K.F. Pathology of flower seeds. *Seed Sci. & Tech.*, 8: 575-89, 1980.
2. BASS, L.V. Flower seed storage. *Seed Sci. & Tech.*, 8: 591-9, 1980.
3. BAKER, J.J. Report on diseases of cultivated plants in England and Wales for the years 1957-68. Tech. Bull No. 25, 322p. HMSO. Publ. London, 1972.
4. BOOTH, C. The Genus *Fusarium*. CMI. Publ. Kew, England, 237p., 1971.
5. BOOTH, C. *Fusarium*. Laboratory guide to the identification of the major species. CMI. Kew, England. 58p., with 112 fig., 1977.
6. DAYAKAR YADAV, B.R. & RAO, V.G. Fungal diseases of ornamental plants from Maharashtra (India). *J. Univ. Poona, Sci. & Tech.*, 54: 179-96, 1981.
7. DE TEMPE, J. Comparison of methods of seed health testing. *Proc. Int. Seed Test Assn.*, 28: 97-105, 1962.
8. ELLIS, M.E. Dematiaceous Hyphomycetes. CMI. Publ. Kew, England. 1971.
9. GREGG, B.R. Seed processing in the tropics. *Seed Sci. & Tech.*, 11: 19-39, 1983.
10. HARMAN, G.E., HEIT, C.L. & BRAVEMAN, S. W. Seed-borne fungi of fresh *Antirrhinum majus* seed. *Pl. Dis. Reptr.*, 55: 639-42, 1971.
11. KULSHRESTHA, D.D. *Colletotrichum aculatum* - A new seed-borne pathogen of *Zinnia*. *Curr. Sci.*, 45: 64, 1976.
12. MUSKETT, A.E. & MALONE, J.P. The ulster method for the examination of flax seed for the presence of seed-borne parasites. *Ann. Appl. Biol.*, 28: 8-13, 1941.
13. MUSKETT, A.E. Technique for the examination of seeds for the presence of seed-borne fungi. *TBMS*, 39: 74-83, 1948.
14. NEERGAARD, P. Seed Pathology Vol. I & II. MacMillan Press Ltd., London and Basingstoke, 1187p., 1977.
15. NOBEL, M. Introduction to series 3 of the hand book on seed health testing. *Proc. Int. Seed Test Assn.*, 30: 1045-115, 1965.
16. RICHARDSON, M.J. An annotated list of seed-borne diseases. 3rd Edition. Phytopathological papers No. 23. 320p. CAB Publ. London, 1979.
17. SURYANARAYANA, D. & BHOMBE, B.B. Studies on the fungal flora of some vegetable seeds. *Indian phytopathol.*, 14: 30-41, 1961.

Recebido para publicação em 26/06/84.