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PATHOLOGY AND CONTROL OF SEED MYCOFLORA OF SOME VEGETABLES IN KERALA*

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Many seed-borne fungi of vegetables are known to cause considerable damage either directly to the seeds that carry them or to the crops that are raised from contaminated seeds (Suryanarayana and Bhombe, 1961; Manoharachary *et al.* 1975; Sinha and Khare, 1977 and Gangopadhyay and Kapoor, 1978). In the present study the seed mycoflora of amaranthus (*Amaranthus gangeticus* L.), bhindi *Abelmoschus esculentus* L.), brinjal *(Solarium melongena* L.), bittergourd (*Momordica charantia* L.) cowpea (*Vigna sinensis* Endl.), cucumber (*Cucumis sativus L),* pumpkin (*Cucurbita pepo* L.), snake gourd (*Trichosanthus anguina* L.) and tomato *(Lycopersicon esculentum* Mill.) were investigated.

Materials and Methods

Seeds of the above vegetables were collected from different districts of Kerala and the mycoflora were studied by the agar plate method described by Suryanarayana and Bhombe (1961).

Isolation of externally seed-borne fungi was done by placing the seeds, without surface sterilization, on a thin layer of potato dextrose agar medium in sterilized petri dishes. Isolation of internally seed-borne fungi was done by using the seeds surface sterilized with 0.1 per cent mercuric chloride for one minute and washed in three changes of sterile distilled water. The seeds were then placed on potato dextrose agar as mentioned above and in both the cases the petri dishes were incubated at room temperature.

The effect of the different fungi on seeds and seedlings was found out by a pot culture experiment using sterile soil (autoclaved at 15 lb pressure for 1 h). The treatment consisted of seeds of the particular vegetable, inoculated with spore suspension of the fungi, and uninoculated seeds served as control. In each pot five seeds were sown and there were three replications. The per cent inhibition in germination over control and the number of seedlings infected were recorded.

In vitro effect of fungicides on the seed-borne fungi was determined by the poisoned food technique (Zentmeyer, 1955) with seven different fungicides, namely, Aureofungin Sol (N–methyl–p–amino acetophenone mycosamine heptane, 50 ppm), Brassico! (penta–chloro–nitro–benzene, 2000 ppm) Captan (N-trichloromethyl thio-tetra-hydrophthalimide, 2000 ppm), Difoiatan (cts N- (1,1,2,2-tetra chloro ethyl thio)-4–cyclohexene-1, 2–dicarboximide, 2COO ppm), Dithane M-45 (zinc ion and manganese ethylene bisdithio-carbamate, 2000 ppm), Dithane Z-78 (zinc ethylene bisdithio carbamate, 2000 ppm) and Thiride (tetra methyl thiuram disulphide, 2000 ppm).

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Results and Discussion

The survey of the seed mycoflora of vegetables revealed the presence of a number of seed-borne fungi (Table 1). Storage fungi like *Aspergillus flavus*, *Aspergillus niger* and *Rhizopus stolonifer* were found to be externally as well as internally seed-borne in almost all the vegetable seeds taken for the study. All the fungi obtained from amaranthus seeds, *Botryodiplodia theobromae* and *Nectria haematococca* from bhindi seeds, all the fungi isolated from bittergourd, *Botryodiplodia theobromae and Drechslera rostrata* from cowpea, *Cephaliophora Irregularis* from pumpkin and all the fungi isolated from snakegourd seeds were new reports. All the other fungi obtained from vegetable seeds tn this sludy were already reported by many workers (Neergaard, 1949; Conroy, 1953; Suryanarayana and Bhombe, 1961; Manoharachary *et al.*, 1975; and Sinha and Khare, 1977).

The results showed that *Achaetomium macrosporum* affected only bitter gourd by way of causing 78.57 per cent inhibition in germination.

Botryodiplodia theobromae caused 41.47, 28.57 and 46.67 per cent inhibition in germination of seeds, respectively, in bhindi, bittergourd and cowpea. Nath *et al.* (1970) reported that *Botryodiplodia theobromae* caused seed rot and seedling blight of mung beans, while in ths present study this fungus was not found to cause any damage on the seedlings.

Cephaliophora irregularis and *Colletotrichum lagenarium* were found to affect only one crop each, viz., pumpkin and bittergourd, but caused 100 per cent inhibition of germination of the seed of the respective crops.

Dreschlera rostrata affected only cowpea causing 38.46 per cent inhibition in the germination of seeds and 20.00 per cent seedling infection.

Fusarium equiseti, F. oxysporum and *F. solani* also affected only one crop each, namely, amaranthus, bhindi and pumpkin, respectively. *F. equiseti* caused 47.00 per cent seedling infection in amaranthus, *F. oxysporum* caused 26.67 per cent inhibition in germination of bhind! seeds and *F. solani* caused 37.5 per cent inhibition in germination of pumpkin seeds. *Rhizopus stolonifer* affected only tomato causing 35.71 per cent inhibition in germination of seeds and 40.00 per cent seedling infection.

The results of the *in vitro* studies on the effect of fungicides on seed-borne fungi are presented in Table 2. In pooled analysis it was found that Thiride was superior to all the other fungicides tested. Against *A, flavus, C. irregularis* and *F . equissti* the effect of Difolatan was on par with Thiride. Aureofungin sol was found to be most effective for the control of *Curvularia lunata* and *Penicillium* sp. but in these cases also Thiride wason par with Aureofungin sol.

Aspergillus flavus caused 100, 33.33, 58.33, 28.57, 15.38, 26.67 and 40.00 per cent inhibition in germination of the seeds of amaranthus, bhindi, brinjal, bittergourd, cowpea, cucumber and snakegourd, respectively, whereas *A. niger*

Table 1

Fungi isolated from the vegetable seeds

Vegetable	Externally seed-borna	Internally seed–borne
Amaranthus	*Aspergillus flavus* Link ex Fr *Aspergillus niger* Van. Teigh. *Curvularia lunata* (Wakker) Boedijine *Fusarium equiseti* (Corda) Sacc. *Myrotheciumroridum* Tode ex Fr.	*Aspergillus ochraceus* Wilhelm *Fusarium equiseti* (Corda) Sacc. *Penicillum* sp.
Bhindi	*Aspergillus f/avus* Link ex Fr. *Aspergillus niger* van Teigh *Fusarium oxysporium* Schlecht	*Botryodiplodia theobromae* Pat. *Fusarium oxysporium* Schlecht *Nectria haematococca* Berk & Br.
Bittergourd	*Aspergillus flaws* Link ex Fr. *Aspergillus niger* van Teigh *Aspergillus ochraceus* Wilhelm *Rhizopus stoionifer* (Fr.) Lind	*Achaetomium macrosporum* Rai. Wadhwani & Tewari *Aspergillus flavus* Link. ex Fr. *Botryodiplodia theobromae* Pat. *Colletotrichum lagenarium* (Pass) Ellis & Halst
Erinjal	*Aspergillus niger* van Teigh *Aspergillus ochraceus* Wilhelm *Rhizopus stolonifer* (Fr.) Lind	*Aspergillus flavus* Link ex Fr,
Cowpea	*Aspergillus flavus* Link ex Fr. *Aspergillus niger* van Teigh *Aspergillus ochraceus* Wilhelm *Botryodiplodiatheobromae* Pat,	*Drechslera rostrata* (Drechsler) Richardson & Fraser *Pencillium* sp. *Rhizopus stoionifer* (Fr.) Lind
Cucumber	*Aspergillus flavus* Link ex Fr.	
Pumpkin	*Aspergillus niger* van Teigh *Rhizopus stoionifer* (Fr.) Lind	*Cephaliophora irregularis* Thaxter *Fusarium solani* (Mart) Sacc.
Snakegourd	*Aspergillus flavus* Link ex *Ft.* *Aspergillus niger* van Teigh *Rhizopus stoionifer* (Fr.) Lind	*Aspergillus flavus* Link ex Fr. An unidentified non–sporulating fungus
Tomato	*Aspergillus niger* van Teigh *Rhizopus stoionifer* (Fr.) Lind	*Aspergillus niger* van Teigh

Table 2

In vitro effect of fungicides on the growth of seed-borne fungi (mean radial growth in mm)*

Fungi	Fungicides							
	Aureo-fungin Sol	Brassi-col	Captan	Difola-tan	Dithane M-45	Dithane Z-78	Thiride	Control
Aspergillus flavus	21,33	22.50	3.83	4.67	23.17	27.50	1.00	85.00
Botryodiplodia theobromae	3050	15.83	16.33	11.83	32.00	12.17	333	85.00
Cephaliophora irregularis	9.00	33.33	8.67	0.00	16.83	37.33	000	8500
Colletotrichum lagenarium	42.82	12.50	25.67	6.17	40.00	17.67	0.00	85.00
Curvularia lunata	4,33	38,83	18.00	31.00	16.17	12.50	6.17	85.00
Drechslera rostrata	30.50	15.83	17.50	9.67	14.33	12.17	4.83	85.00
Fusarium equiseti	6,00	32.83	7.50	0.67	46.33	36.50	0.00	85.00
Myrothecium roridum	6.50	53.17	18 00	25.00	16.17	17.00	1.00	85.00
Nectria haematococca	21.33	15.83	17.00	15.17	51.00	53.80	11.33	85.00
Penicillium sp.	4.33	39.00	17.66	31.00	16.17	12 50	6.33	85.00
Rhizopus stolonifer	21.50	2.00	4.50	22.00	23.17	25.83	0.00	85 00

* Average of three replications

C.D. (0.05) for comparison between fungicides = 5.33

C. D. (0.05) for comparison between fungicides and conlrol = 9.23

was found to affect only tomato, amaranthus and bhindi by causing 64.29 per cent inhibition in germination of seeds of tomato and 37.00 and 33.33 per cent seedling infection in amaranthus and bhindi, respectively. Seedling infection caused by *A. niger* has been reported in groundnut by Suryanarayana (1978).

Summary

The survey of the seed mycoflora of certain vegetable seeds viz., amaranthus, bhindi, bittergourd brinjal, cowpea, cucumber, pumpkin, snakegourd and tomato revealed that storage fungi like *Aspergillus flavus, Aspergillus niger* and *Rhizopus stolonifer* were externally as well as internally seed-borne in almost all the vegetable seeds taken for the study and were found to cause maximum inhibition in germination of the seeds, from which they were isolated. Seedling rotting was caused by *Fusarium equiseti* on amaranthus, *Aspergillus niger* on amaranthus and bhindi, *Drechslera rostrata* on cowpea, and *Rhizopus stolonifer* on tomato. *In vitro* evaluation of fungicides showed that Thiride was found to be superior to all other fungicides tested against the seed-borne fungi.

സംഗ്രഹം

ചീര, വെണ്ട, പാവൽ, വഴുതന, പയറ്, വെള്ളരി, മത്തൻ, പടവലം, തക്കാളി എന്നീ പച്ചക്കറി വിത്തുകളിലെ സൂക്ഷ്മ ജീവികളെപ്പറ്റി പഠനം നടത്തിയതിൽ *ആസ്പർജില്ലസ് ഫ്ളേവസ്, ആസ്പർജില്ലസ് നൈഗർ, റൈസോപസ് സ്റ്റോളോണിഫർ* എന്നീ ഫംഗസ്സുകൾ മിക്കവാറും എല്ലാത്തരം വിത്തുകളിലും ബാഹ്യമായും ആന്തരികമായും വ്യാപിച്ചിരിക്കുന്നതായി കാണപ്പെട്ടു. ഈ ഫംഗസ്സുകൾ വിത്തുകളുടെ അങ്കുരണശേഷിയെ ഗണ്യമായി തടസ്സപ്പെടുത്തുന്നതായും തെളിയുകയുണ്ടായി. കൂടാതെ ഇത്തരം ചില ഫംഗസ്സുകൾ തൈച്ചെടികളിൽ അഴുകൽ ഉണ്ടാക്കുന്നതായും കണ്ടു. പലതരം കുമിൾനാശിനികൾ പരീക്ഷണശാലയിൽ ഉപയോഗിച്ചു നോക്കിയതിൽ തൈറൈഡ് എന്ന കുമിൾനാശിനി വിത്തുമൂലം വ്യാപിക്കുന്ന ഫംഗസ്സുകളെ നശിപ്പിക്കുവാൻ ഏറ്റവും ഫലപ്രദമായി കാണപ്പെട്ടു.

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