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EFFECT OF ENVIRONMENTAL FACTOR ON FUNGAL POPULATION

KEYWORDS: RH. Fungal incidence

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ABSTRACT The four drug plant parts viz., Ricinus communis (seed), Carthamus tinctorius (seed), Sida cordifolia (root) and Plumbago zeylanica (root) were stored at different humidities (33, 55, 75 and 96%) for 50, 100 and 150 days. Out of four samples, the maximum fungal incidence was observed in case of R. communis (seeds) during storage at 96% RH in 150 days. However, minimum fungal population was noted at 33% RH in 50 days of incubation in the roots of P. zeylanica.

Introduction

The occurrence and abundance of microorganisms on a particular host is controlled by environmental conditions. These environmental factors like humidity & temperatures also determine the medicinal value of the plants or their parts by influencing the fungal flora on them during storage. The moisture content of stored plant parts viz; roots, seeds and stems fluctuate considerably with the change in the atmospheric humidity as well as with the hygroscopic nature of the sample. As such, it was considered worth to study the influence of relative humidity on the variation of fungal incidence during storage of various medicinal plant parts.

Materials and Methods

The effect of different relative humidity levels during storage was studied following the method of Wink and Sear (1950). To maintain various RH levels viz 33, 55, 75 and 96% saturated solutions of magnesium chloride ($MgCl_2$, $6H_2O$), magnesium nitrate ($Mg(NO_3)_2$), sodium chloride (NaCl) and potassium nitrate (KNO_3), respectively were prepared and placed in sterilized dessicators. Subsequently three lots of test sample each of 100g, were put in muslin cloth bags and were stored at desired RH for 150 days. At every 50 days interval, samples were analyzed for fungal incidence by plating the seeds and roots of stored plant material on blotting paper.

Results and Discussion

Ricinus communis. Heathly seeds of R.communis exhibited 39% of incidence of fungi (Table 1, Fig.I). Seven fungi viz, *Alternatia alternate, Curvularia lunata, Aspergillus flavus, A. niger, Fusarium noniliforme*, F. *oxysporum, Penicillium citrinum,* and *Mycelid sterilia* were detected at 33% RH after 50 days storage. The numbers as well as the percentage of fungal incidence increased gradually with the increase in the storage period and RH. The maximum fungal incidence was observed 96% RH after storage for 150 days. Out of twelve isolates, *A flavus* showed maximum incidence while *Chaetomium cristatum* exhibited the least occurrence at 96% RH.

Carthamus tinctorius. The control of *C.tinctorius* showed 39% fungal incidence (Table 2, Fig. II). A very slight variation in the numbers of mycoflora was recorded at 33% RH at all the incubation periods which increased with increase in RH as well as storage period. The maximum incidence of fungi was noticed at 96% RH in 150 days. *A. flavus, F. monliforme, P.citrinum, Rhizopus stolonifer* and *A.alternata* were common fungal flora at all RH levels throughout period of incubation. *Aspergillus candidus, A. niger, A.nidulans, C.cristatum, Helminthosporium spiciferum* and *Mycelia sterilia* were recorded only at RH 75 and 96%.

Sida cordifolia. In all, eight fungi, viz, *A. flavus, A. niger, A. condidus, Chaetomium globossum, C.cristatum, Fusarium oxysporum, F. moniliforme* and *A. alternate* were isolated form healthy samples of *S. cordifolia.* The fungal incidence recorded for control root samples increased gradually under different RH levels and incubation periods. A minimum incidence was noted at RH 33% in 50 days while a maximum was observed at RH 96% in 150 days after storage *C.cristatum* and *C.globossum* were isolated only at RH 96% (Table 3, Fig. III).

Plumbago zeylanica. *A.alternata, Curvularia, lunata, A.flavus, A.niger, C.globossum, F. moniliforme* and R.stolonifer were found to be associated with healthy roots of *P. zeylanica.* Storage of roots at higher RH levels for longer intervals had increased fungal incidence. At RH 55 and 75%, fungal incidence was between 29 to 41% after 50 days which increased to 91% with the rise in the RH to 96% in 150 days of storage (Table 4, Fig. IV)

A comparative analysis shows that all the four test samples exhibited maximum fungal incidence during storage at RH 96% after 150 days storage. Conclusively it may be stated that the storage of seeds and roots at higher RH favours greater fungal colonization as compared to their storage at lower RH (Christensen 1971). It may also be suggested that the numbers and nature of mycoflora were altered considerably at various periods of storage. Similar results were also observed by Singh (1992), Kaushik and Gupta (1989) and Sharma and Gupta (1993).

The earlier studies by Wallace and Sinha (1962) have suggested that high moisture content of stored commodities greatly influenced the microbial growth by influencing their enzymatic activity. Similarly Sinha and Wallace (1977) reported that change in temperature and moisture affect the fungal infection of the stored samples. Singh et al (1987) also noticed that sporulation of *Sclerospora graminicola* was greatly affected by RH and temperature. The increased fungal incidence during the present investigation at higher RH under prolonged storage may be attributed to the availability of adequate amount of moisture favouring growth of storage fungi (Kadian 1989, Kumari and Roy 1990, Singh 1992, Singh & Prasad 1992, Singh et al 1995, Dubey 2005).

Table 1: Percent incidence of fungal organisms on Ricinus communis seeds at different RH.

	Control	33% RH			55% RH			75% RH			96% RH		
Fungi		50 days	100 days	150 days	50 days	100 days	150 days	50 days	100 days	150 days	50 days	100 days	150 days
Altemaria alternate	1	2.5	3.2	5.9	3.5	6.7	8.4	5	7.5	9.8	8.6	10.1	11

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Aspergillus candidus	-	-	-	-	-	-	-	4.5	5	5	5.3	5.6	6.8
A. flavus	7	7.8	8.3	10.5	11	13.3	15.6	14	18.1	20.2	19.5	23.2	25
A. niger	7.6	8.2	9.3	10.4	9.8	10.9	12.8	11.4	12.6	15.9	13.4	15.8	19.1
Chaetomium globossum	-	-	-	2	-	-	3	-	-	4	-	5.3	6.8
C. cristatum	-	-	-	-	-	-	-	-	-	-	-	3	4.1
Curvularia lunata	3	3.5	4.2	4.5	5.2	6.1	6.8	5.5	6.6	7.3	6.2	7.8	8.4
Fusarium moniliforme	10	10	10	10	10.2	11.3	13.6	11.8	13.6	14.7	15.2	17.6	23.6
F oxysporum	2	1.5	1.2	1.8	2.2	3.5	4	3.9	4.8	5.6	5.5	6.5	8.5
Mycelia sterilia	1.5	-	-	-	2	3.3	4.8	6	7.5	9.2	7.9	10	12
Penicilium citrinum	2.8	3	3.5	5	4.8	6	8.8	7.1	9.3	11.3	8.8	11.1	12.6
Rhizopus stolonifer	4	-	-	5	3.3	6.8	9	5.9	8.3	10.8	9	11.1	13.8
Total Number of Fungi	9	6	7	8	9	9	10	10	10	11	10	12	12
Total % incidence of Fungi	38.9	36.5	39.7	55.1	52	67.9	86.8	75.1	93.3	113.8	99.4	127.1	151.7

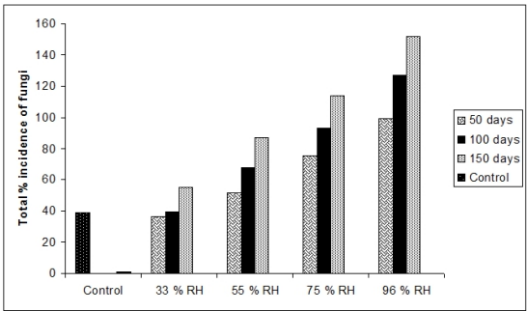

Fig. I: Percentage of fungi on Ricinus communis seeds stored at different RH

Table : 2

Percent incidence of fungal organisms on Carthamus tinctorius seeds at different RH.

Fungi	Control	33% RH			55% RH			75% RH			96% RH		
		50 days	100 days	150 days	50 days	100 days	150 days	50 days	100 days	150 days	50 days	100 days	150 days
Alternaria alternate	1	2	3	5	4.5	6.5	7.8	7.3	9.3	9.9	9.5	10.3	10.8
Aspergillus candidus	3	3.5	5	7	6	8	11	9.5	11.2	12	10.2	-	-
A. flavus	13	13	15	18	20	22	24	25	27	28	26	28	30
A. niger	2	3	7	9	8	10	12	11	13.5	14	-	-	-
Chaetomium globossum	5	-	-	-	-	-	-	-	-	-	4.5	6.8	8.3
C. cristatum	4	-	-	-	-	-	-	-	-	-	-	-	6.3
Curvularia lunata	-	-	-	-	-	6.3	7.3	6.8	7.7	8	7.9	9.8	11.3
Fusarium moniliforme	8	8	8	8.8	8.5	9.3	10	9.8	10.5	14	16.3	19.5	25
F oxysporum	3	-	-	-	6.5	7.3	8	6.6	7.9	5.6	8.6	9.1	9.8
Helminthosporium speciferus	-	-	-	-	-	-	-	3.5	4.2	5.2	5	6.3	7.8
Rhizopus stolonifer	-	-	-	-	-	-	-	13	15	16	14	16	18
Total Number of Fungi	8	5	5	5	6	7	7	9	9	9	9	9	9
Total % incidence of Fungi	39	29.5	38	47.8	53.5	69.4	80.1	92.5	106.3	112.7	102	105.8	127.3

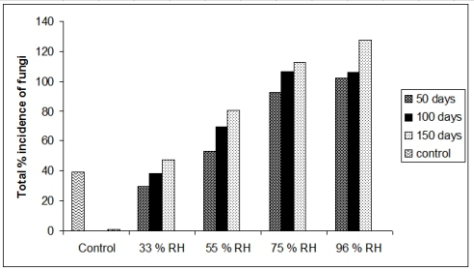

Fig. II. Percentage of fungi on Carthamus tinctorius seeds stored at different RH.

Table : 3

Present incidence of fungal organisms on Sida cordifolia roots at different RH.

Fungi	Control	33% RH			55% RH			75% RH			96% RH		
		50 days	100 days	150 days	50 days	100 days	150 days	50 days	100 days	150 days	50 days	100 days	150 days
Alternaria alternate	4.2	3	3.5	4	4	4.8	5.3	5.7	6.8	7.3	6.7	8.5	9.4
Aspergillus candidus	3	-	-	-	-	-	-	-	-	3	4	4.9	5.6
A. flavus	7.3	8.5	8.5	9	7.4	9	11	11.5	14.5	18.1	15.5	19.5	19.5
A. niger	1.2	-	-	-	-	-	-	-	-	3	3	3.4	4.5
A. nidulence	-	-	-	-	-	-	-	-	-	-	3.2	4.3	5.4
Chaetomium globossum	3	-	-	-	-	-	-	-	-	-	-	6.7	7.3
C. cristatum	-	-	-	-	-	-	-	-	-	-	-	-	3.6
Fusarium moniliforme	-	6	6	6	6.3	8.5	10.4	9.6	12.9	15.3	16.8	19.6	23.8
Helminthosporium speciferus	6	-	-	-	-	-	-	3.6	4.5	5.6	6.7	7.9	8.3
Nucelia sterilia	-	-	-	-	-	-	-	-	-	-	-	3.2	4
Penicilium citrinum	2	3	-	5	4.3	6.6	7.8	5.8	7.5	8.6	6.6	7	9.3
Rhiopus arrhizus	5.3	3.8	4.3	5.6	5.5	6.8	7.8	6.5	7.3	7.9	7.5	8.3	8.6
Total Number of Fungi	8	5	4	5	5	5	5	6	6	8	9	11	12
Total % incidence of Fungi	32	24.3	22.3	29.6	27.5	35.7	42.3	42.7	53.5	68.8	70	93.3	109.3

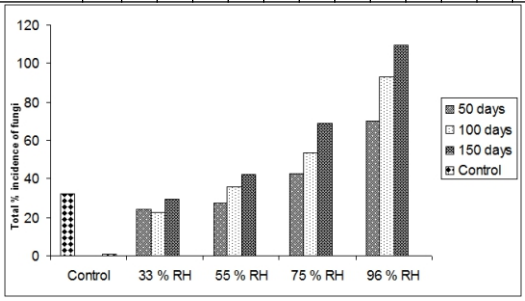

Fig. III: Percentage of fungi on Sida cordifolia roots stored at different RH.

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Table : 4

Percent incidence of fungal organisms on Plumbago zeylanica roots at different RH.

Fungi	Control	33% RH			55% RH			75% RH			96% RH		
		50 days	100 days	150 days	50 days	100 days	150 days	50 days	100 days	150 days	50 days	100 days	150 days
Alternaria alternate	1	1.2	3.2	4.1	-	-	-	-	-	-	-	-	-
Aspergillus flavus	8.8	8	9	11	9.5	11.5	15	12.8	15.5	17.6	14.6	18.9	23.3
A. niger	3	2	2.5	3	3.5	4.6	5.1	4.8	5.3	5.8	5.1	6.2	7.3
A. nidulans	-	-	-	-	-	-	-	-	-	-	2.3	3.3	5.2
Chaetomium globossum	3.6	2.5	2.9	3.3	3.5	4.3	5.6	5	6.1	7.3	6.2	7.8	8.9
C. indicus	-	-	-	-	-	1.3	1.8	2.3	2.5	3	3.3	4.1	6.6
Curvularia lunata	2	1.8	2.3	3.4	2.8	3.6	4.7	4.5	5.6	6.7	6.8	7.3	8.6
Fusarium moniliforme	6	4.5	5.3	6.8	8.6	9.3	10.9	9.5	12.6	15	14.9	19.6	23
Penicilium citrinum	1.5	1.3	1.5	1.8	1.5	2.1	2.8	2.5	3	3.3	2.9	3.8	4.5
Rhizopus stolonifer	2	-	-	-	-	-	-	-	-	-	1.3	2.1	3.1
Total Number of Fungi	8	7	7	7	6	7	7	7	7	7	9	9	9
Total % incidence of Fungi	27.9	21.3	26.7	33.4	29.4	36.7	45.9	41.4	50.6	58.7	57.4	73.1	90.5

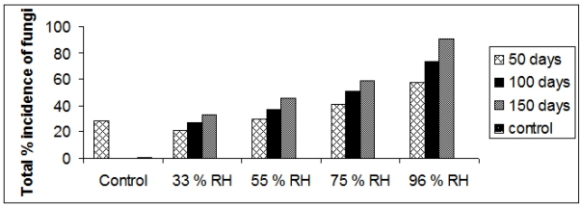

Fig. IV: Percent of Fungi on Plumbago zeylanica roots stored at different RH.

References:

1. Christensen CM. (1971): Invasion of sorghum seed by storage fungi at moisture contents of 13.5-15% and condition of sample from commercial bins. Mycopath Mycol Appli 44: 272-182.
2. Dubey SC. (2005): Influence of weather factors on development of Alternaria blight of broad bean. J Mycol and Pl Pathol 32(2): 369-372.
3. Kadian OP. (1989): Effect of environment on incidence and development of crinckle disease in urid bean. Indian Phytopath 42(2): 273.
4. Kaushik JC and Gupta VK. (1989): Factors affecting seedling blight of eucalyptus caused by Cylindrocaladium quninqueseptatum. Indian Phytopath. 42(2):276-277.
5. Kumari V and Roy AK. (1990): Biodeterioration of Embelia ribes seeds under the influence of different relative humidities. Natl Acad Sci Lett. 13(5): 167-169.
6. Singh HNP. (1992): Studies on diseases of banana A pathological and biochemical approach Ph.D. Thesis Bhagalpur University, Bhagalpur.
7. Singh HNP, Prasad MM and Kumari S. (1995): Effect of temperature and humidity on microbial deterioration of banana fruits. Advances in Plant Science. 8(1): 148-151.
8. Singh HNP and Prasad MM. (1992): Effect of temperature and humidity on fungal spoilage of two varieties of banana. Indian Bot Rep 11(1+2): 85-86.
9. Singh SD, Gopinath R and Pawar MN. (1987): Effect of environmental factors on asexual sporulation of Sclerospora graminocola. Indian Phytopath. 40(2): 186-193.
10. Sinha RN and Wallance HAH. (1977): Storage stability of farm stored rapeseed and barley. Can J Plant Sci 57: 351.
11. Sharma KK and Gupta VK. (1993): Effect of temperature and relative humidity on conidial germination and germ tube length of Podosphaera leucotricha on apple leaves. Indian Phytopath 46(4): 408-411.
12. Wallace HAH and Sinha RN. (1962): Fungi associated with hot spots in farm stored grains can J Pl Sei 42: 130.
13. Wink SA and Sears GR. (1950): Instrumentation studies LVII. Equilibrium relative humidities above saturated solutions at various temperature. Tappi. 33(9): 96A-97A.