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INFLUENCE OF STORAGE RELATIVE HUMIDITY ON VIABILITY OF *AMARANTHUS HYPOCHONDRIACUS*, *BRASSICA OLERACEA* AND *GLYCINE MAX*

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The storage temperature and relative humidity are two most important factors influencing seed viability. The critical moisture content is crop specific. The seeds equilibrate with the ambient humidity to particular moisture content at a particular temperature. The relationship between seed moisture and viability at different relative humidities and 35°C, was studied over a period of 150 days in *Amaranthus hypochondriacus*, *Brassica oleracea* and *Glycine max*. The three crops under investigation showed a rapid loss in the germination percentage at higher relative humidities of 90 and 75%. More pronounced effect was observed for *G. max* followed by *B. oleracea* and *A. hypochondriacus*. The proximate composition of the seeds is an important factor in determining the equilibrium moisture content of the seed.

Key words: Relative humidity, viability, storability, *Amaranthus hypochondriacus*, *Brassica oleracea*, *Glycine max*

The accessions received in a genebank are of different crops and many of them are from endangered populations. The determination of proper storage conditions is of prime importance to preserve this heritage for posterity. This assumes greater significance in the context of germplasm storage sites where controlled environmental conditions are not available. The early experiments on storage conditions of seeds showed that the storage temperature and relative humidity (RH) are important factors, which influence the seed moisture content and thus have a bearing on the storage life of the seeds (Roberts 1973).

To understand the exact relationship between the two variables the seeds of *Amaranthus hypochondriacus*, *Brassica oleracea* and *Glycine max* were allowed to equilibrate at different humidities. These samples were then stored at respective humidities at 35°C (commonly prevailing temperature in sub-tropical region) and the changes in the viability were periodically monitored over 150 days of storage.

MATERIALS AND METHODS

Seeds of *Amaranthus hypochondriacus* variety "Annapurna", *Brassica oleracea* variety "GA", and *Glycine max* variety "Gaurav" were procured from National Seeds Corporation, New Delhi.

The seeds were equilibrated to different moisture contents using various saturated salt solutions to 11, 32, 50, 75 and 90% relative humidities (RH) at 35°C temperature (Vertucci and Roos 1993). The equilibrated seeds were stored at respective RH at 35°C temperature. The viability was tested at regular intervals over a period of 150 days.

Seed moisture was determined by hot air oven method (ISTA, 1985).

Viability was assessed through germination test using 150 seeds in three replications and evaluated on the seventh day as per ISTA rules (ISTA, 1985).

RESULTS AND DISCUSSION

The moisture content to which the seeds of *A. hypochondriacus*, *B. oleracea*, and *G. max* equilibrated to various humidities is given in Table 1.

Table 1. Moisture content (Fw basis) in seeds of *Amaranthus hypochondriacus*, *Brassica oleracea* and *Glycine max* when equilibrated at 35 °C at different relative humidities for a period of 150 days

Relative Humidity (%)	*A. hypochondriacus*	*B. oleracea*	*G. max*
11	4.9	3.0	3.5
32	7.5	3.9	5.0
50	8.5	4.5	6.0
75	13.5	9.5	12.2
90	16.8	13.5	16.5

The change in the viability of the seeds of *A. hypochondriacus*, *B. oleracea*, and *G. max* when stored at 11, 32, 50, 75 and 90% RH at 35 °C for 150 days is shown in Fig. 1. The seeds of *A. hypochondriacus* could maintain 100% germination at RH 11%, 32% and 50% for 150 days. The viability declined to 8% in 115 days of storage at 75% RH whereas at 90% RH the seed viability declined to 3% after 90 days of storage. The viability of *B. oleracea* seeds declined to 60% during the total storage period at 11% RH, whereas at 32 and 50% RH the seeds could retain 80 and 60% germination respectively for this period. The viability decline is more pronounced at 75 and 90% RH where no germination was observed after 75 and 60 days of storage respectively. In *G. max* the viability of the seeds declined to 58% and 68% during the total storage period (150 days) at 11% and 32% RH respectively. The deterioration was faster at 50% RH leading to a decline in viability to 42% during the same storage period. Storage at 75 and 90% RH resulted in a total loss of viability in the seeds after 75 and 24 days of storage respectively.

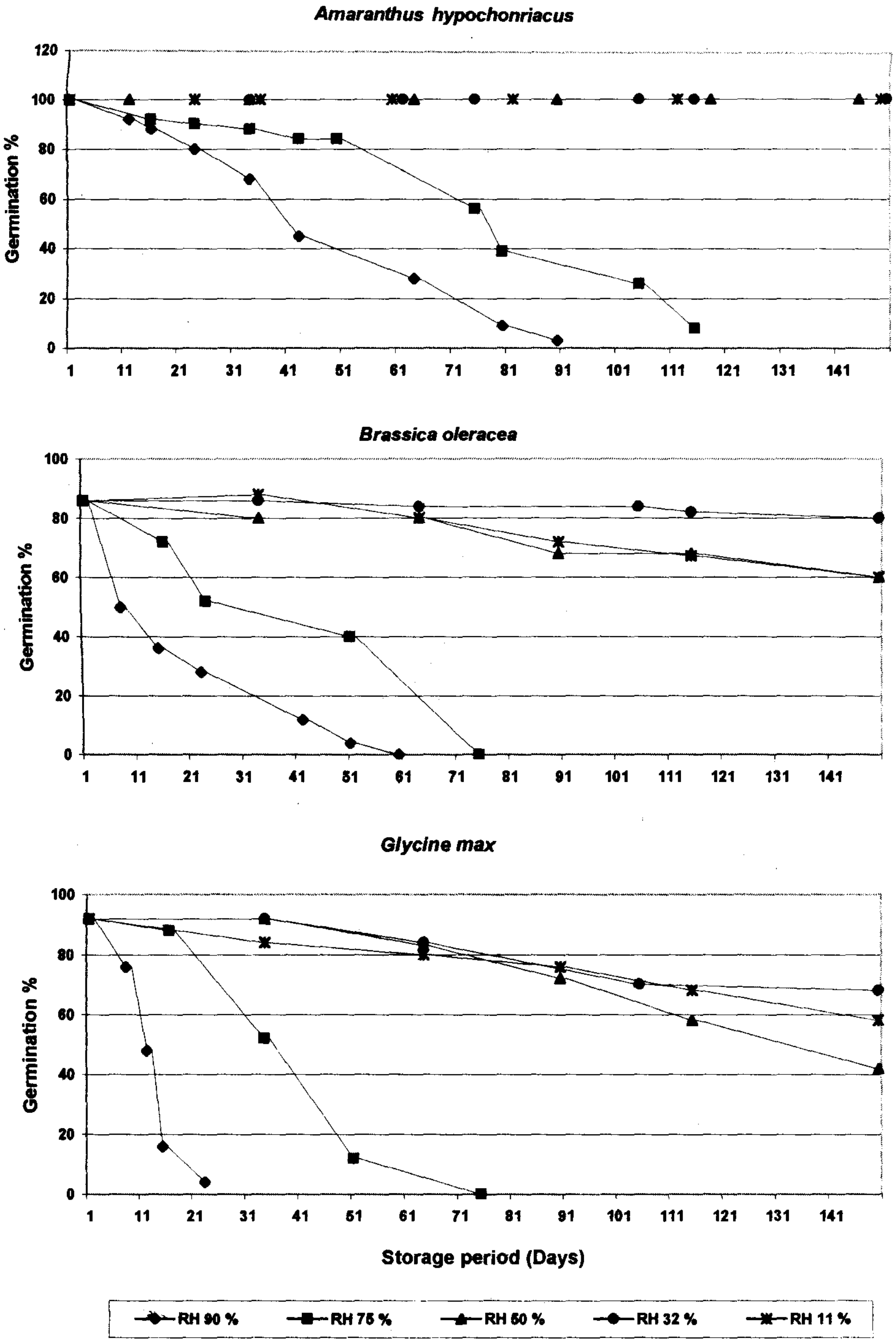

Fig. 1. Changes in the viability of seeds of *Amaranthus hypochondriacus*, *Brassica oleracea* and *Glycine max* when stored at 35°C at different relative humidities for a period of 150 days

It was found that the seed moisture content at a particular humidity varied for the three crops studied. The proximate composition of the seeds is an important factor in determining the equilibrium moisture content of the seed and similar differences have been reported for other crops (Vertucci and Roos 1993). The three crops showed a similar trend of seed deterioration wherein a rapid loss in the germination percentage was observed at higher RHs of 90 and 75 per cent. More pronounced effect was observed for *G. max* followed by *B. oleracea* and *A. hypochondriacus*. Relatively higher seed viability of 80 per cent and 68 per cent was observed in *B. oleracea* and *G. max* respectively at 32 per cent RH, as compared to 11 and 50 per cent RH. Non enzymatic auto oxidations leading to free radical production have been reported to result in loss of viability at lower moisture contents (Koostra and Harrington 1969). The differential response of the three crops may be attributed to the high oil content and the fatty acid composition of *G. max* and *B. oleracea* seeds, making them more prone to peroxidative changes as compared to the starchy seeds of *A. hypochondriacus*. It has been reported that the high linolenic acid content (50-60%) present in the oil of *G. max* renders it more vulnerable to enzymatic oxidations especially at higher moisture content. Consequently the production of highly reactive hydroperoxides reduce the storage life of seeds (Stewart and Bewely 1980, Buchvarov and Gantcheff 1984, Senaratana *et al.* 1988).

The results imply that maintaining the relative humidity in the storage environment of the seeds to a level of 30-35% can help in better short-term storage of seeds at places where the temperature is about 35°C. Moreover, in places where the ambient temperatures are lower it shall have additional benefits in improving the shelf life of the seeds.

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