EFFECT OF MOISTURE CONTENT, STORAGE CONDITION AND SEED DIMENSION ON SEED GERMINATION OF *ANDROGRAPHIS PANICULATA* (BURM.F.) NEES

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Abstract

Andrographis paniculata (Burm.f.) Nees is one of the commonly used medicinal plant. Its seed germination percentage are gradual decrease with increase in storage time from 4-24 months. However, at 10°C the loss of germination after 18 and 24 months was less in comparison to 15°C after the same period of storage. At partial vacuum condition the seed germination did not show appreciable enhancement in percentage germination in *A. paniculata* at room temperature, there was an increase in percent of germination. The loss of germination at lower temperature was comparatively less with increase in storage period. Moisture content of seeds of medicinal plant species stored up to 18 months period in three storage conditions viz. polythene bags, gunny bags and cloth bags. It shows that in plant species storage period and storage conditions are significant. As per storage condition highest moisture up to a period of 24 months was retained in polythene bags following by cloth bags and gunny bags. Effect of seed dimensions and weight on percentage germination, indicate a positive relationship between the percent germination and seed weight. The heavier seeds possessed higher percent germination in medicinal plant species. The same trend was also observed in relation to seed width. The narrow seeds possessed least germination percentage while the wider seeds showed highest percent germination. This research paper is to be discussed about "**Effect of moisture content, storage condition and seed dimension on seed germination of *Andrographis paniculata* (Burm.f.) Nees"**

Keywords: *Andrographis paniculata,* moisture content, storage condition, seed dimension and seed germination.

Introduction

Plants have been used for medicinal purposes long before prehistoric period. Ancient Unani manuscripts Egyptian papyrus and Chinese writings described the use of herbs. Traditional systems of medicine continue to be widely practised on many accounts. Population rises, inadequate supply of drugs, prohibitive cost of treatments, side effects of several synthetic drugs and development of resistance to currently used drugs for infectious diseases have led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments. Among ancient civilisations, India has been known to be rich repository of medicinal plants. Recently, WHO (World Health Organization) estimated that 80 percent of people worldwide rely on herbal medicines for some aspect of their primary health care needs.

Image 1. *Andrographis paniculata*

According to WHO, around 21,000 plant species have the potential for being used as medicinal plants. Medicinal plants are considered as rich resources of ingredients which can be used in drug development either pharmacopoeia, non-pharmacopoeia or synthetic drugs. The leaves of *Andrographis paniculata* are used as a medicinal herb in the treatment of infectious diseases. (Joanna and Ernst, 2004).

Andrographis paniculata belongs to Acanthaceae family. It is commonly known as Kalmegh, creat or green chiretta. It is a medicinal plant traditionally used as anti-inflammation and anti-bacteria herb. Andrographolide, the major active component of *A. paniculata*, exhibits diverse pharmacological activities, including anti-inflammation, anti-cancer, anti-obesity, anti-diabetes, and other activities (Dai *et al*. 2019). *A. paniculata* extracts could inhibit expression of several cytochrome C enzymes and thus interfere with metabolism of other pharmaceuticals (Ram Mohan *et al*.2012). *Andrographis paniculata* possesses anti-inflammatory effects, attributed to the main constituent andrographolide proposed as alternative in the treatment of autoimmune disease (Burgos *et al.* 2009). Acute respiratory infections represent a significant cause of over-prescription of antibiotics and are one of the major reasons for absence from work. The COVID-19 pandemic has intensively disrupted global health, economics, and well-being. *Andrographis paniculata* has been used as a complementary treatment for COVID-19 in several Asian countries. The hepatoprotective effects of ethanolic *Andrographis paniculata* leaf extract (ELAP) on thioacetamide-induced hepatotoxicity in rats (Bardi *et al.* 2014). The antimicrobial activity of aqueous extract, andrographolides and arabinogalactan proteins from *Andrographis paniculata* were evaluated (Singha 2003). Seeds play an important role in crop production. Healthy seed will produce high viability and vigour as well as maintaining its purity. Contrarily, non-uniform seeds give poor performance when growing in the field. In order to obtain uniformity of seeds, sortation of the seed must be done by using seed grader based on the seed size. The quality of seed is easily decreased, so that it is difficult to keep them for a long time. Environment factors in influencing the life span of seeds are relative humidity, temperature, and initial moisture content of seed.

Materials and method

Seed collection and storage:

Seed storage requires special treatment to maintain the quality of seeds during the storage period. Different factors that highly affect the storage of seeds include: the initial moisture content seeds when stored, the use of packaging or an airtight container and storage space with humidity and low temperature.

Seeds of *Andrographis paniculata* was collected from various sites of Damoh district (India). Seeds were surface-sterilized in a warm water bath at 50°C for 20 min to reduce the risk of fungal growth. Thereafter, seeds were chilled in cold distilled water, evenly spread on a piece of germination paper and dried overnight at 20°C. Later seeds were stored in sealed polythene bags at room temperature 10($\pm$1)^{0}C, 15($\pm$1)^{0}C, 28($\pm$2)^{0}C and 40($\pm$2)^{0}C and 90($\pm$1)^{0}C

% relative humidity and also stored in sealed desiccator and partial vacuum was created using rotator vacuum pump "Gevivek" Compressor ¼ HP at 28" HG.

SEEDS SIZE AND WIEGHT

Size of the test species i.e., *Andrographis paniculata* was measured by screw gauge and the weight was taken by pan balance of 0.01 mg accuracy. Germination test was conducted by placing 24x4 seeds types as for size weight in petri dishes on two moistened sterilized filter paper at 30(±2)^{0}C in a seed germinator (SEW India). New germinant were recorded daily.
Emergence of radicle was taken as the criterion of germination.

MOISTURE

Seed moisture determination done in triplicate on three independently prepared samples (10 g. seeds) for each species. The seeds were placed inside paper packets in an oven at 95±^{0}C for 24 hours, cooled in a desiccator and re weighed. Moisture content was calculated and expressed as follows.

Moisture Content (%) = (Fresh Weight- Oven dry weight)/Fresh weight × 100

Moisture content as affected by storage from fresh seeds to 24 months old seeds were determined.

RESULTS AND DISCUSSION

The results of seed storage at different temperatures are presented in Table 1 for a medicinal plant species and Fig. 1. A perusal of Tables 1 and fig. 1 indicates that in case of *A. paniculata*, there are gradual decrease in seed germination percentage with increase in storage time from 4-24 months. However, at 10°C the loss of germination after 16 and 24 months was less in comparison to 15°C after the same period of storage. At partial vacuum condition the seed germination did not show appreciable enhancement in percentage germination in *A. paniculata* at room temperature, there was an increase in percent of germination. The loss of germination at low temperature was comparatively less with increase in storage period.

Image 2. Seed of *Andrographis paniculata*

Image 3. Seed germination of *Andrographis paniculata*

However, the germination percentage of seeds stored at 10($\pm$1)^{0}C showed a slight decrease till 8 months of storage, followed by a gradual decline till 24 months. Storage temperature at 10($\pm$1)^{0}C, 15($\pm$1)^{0}C, 28($\pm$2) ^{0}C and 40($\pm$2)^{0}C shows decrease in germination percent up to 24 months. When the seeds were stored at 90(±1) % relative humidity at constant temperature of 30°C, the seeds lost their viability very soon. The loss of seed viability at higher temperature may be attributed to the higher respiratory rates and other metabolic activities as a result of which, the reserve food material was used up within a short period. A higher decline in germination at different temperature and open conditions might be due to the fluctuation of moisture content of seeds, without control of humidity or too frequently opening and resealing of the polythene bags (Wang 1974, Stain *et al* .1974). In addition to low temperature a favourable effect of sealed storage on the maintenance of viability of confers have been reported by a number of workers (Haack, 1909, Miller, 1930: Barton, 1935). The seed viability was found to be the best at lower temperature i.e., 10(±1)^{0}C. After 8 month they nearly lost their viability completely even they were stored in sealed polythene bags.

Better results have been found in the partial vacuum condition where 50% germination was found. It may be due to the reduction in the rate of aerobic respiration to exclude oxygen from the atmosphere surrounding the seeds (Roberts,1973). However, decline in germination percent was comparatively less at lower and higher temperature of 10(±1)^{0}C and 40(±2)^{0}C. At partial vacuum there was no effect of storage on percent germination in this species.

Effect of storage on germination in *A. paniculata* (Table 1, Fig. 1) significant. There was a decline in percent germination with increase in the storage period from 4-24 months. The results indicate that the best condition of storage without appreciable decline in percent germination was at partial vacuum in *A. paniculata* species. Most of the seeds possess capability to retain viability for a longer period if stored at lower temperature of around 10°C and a moisture percent of less than 10% on the other hand certain seeds cannot tolerate desiccation and therefore, moisture content cannot be lowered below a certain critical level Jain (2007). Such seeds cannot be stored at lower temperature for a longer period as freezing injury may be detrimental. Roberts (1973) has classified, the earlier category as orthodox and later the recalcitrant seeds. *A. paniculata* species under observation can be placed in these classifications into orthodox category. Results indicate that best results of plant species are found in partial vacuum condition which may be due to decline in the rate of aerobic respiration to exclude oxygen from the atmosphere surrounding the seeds. According to Roberts (1973) seeds of Lettuce were stored in sealed containers at 6% moisture content and 18°C. After 3 years seeds stored in an atmosphere of pure oxygen had 8% seed viability, those in air 57%, those in nitrogen or argon or CO, 78% and those in vacuum 77% seed viability. The complete absence of oxygen from the storage atmosphere appears beneficial to most orthodox seeds. There is however evidence that some oxygen in essential for recalcitrant seeds. Seeds of *Araucaria hunsteinii* were all dead in 11 weeks if stored in 5% oxygen but still gave 60% germination if stored in 10% oxygen Tompsett (1983).

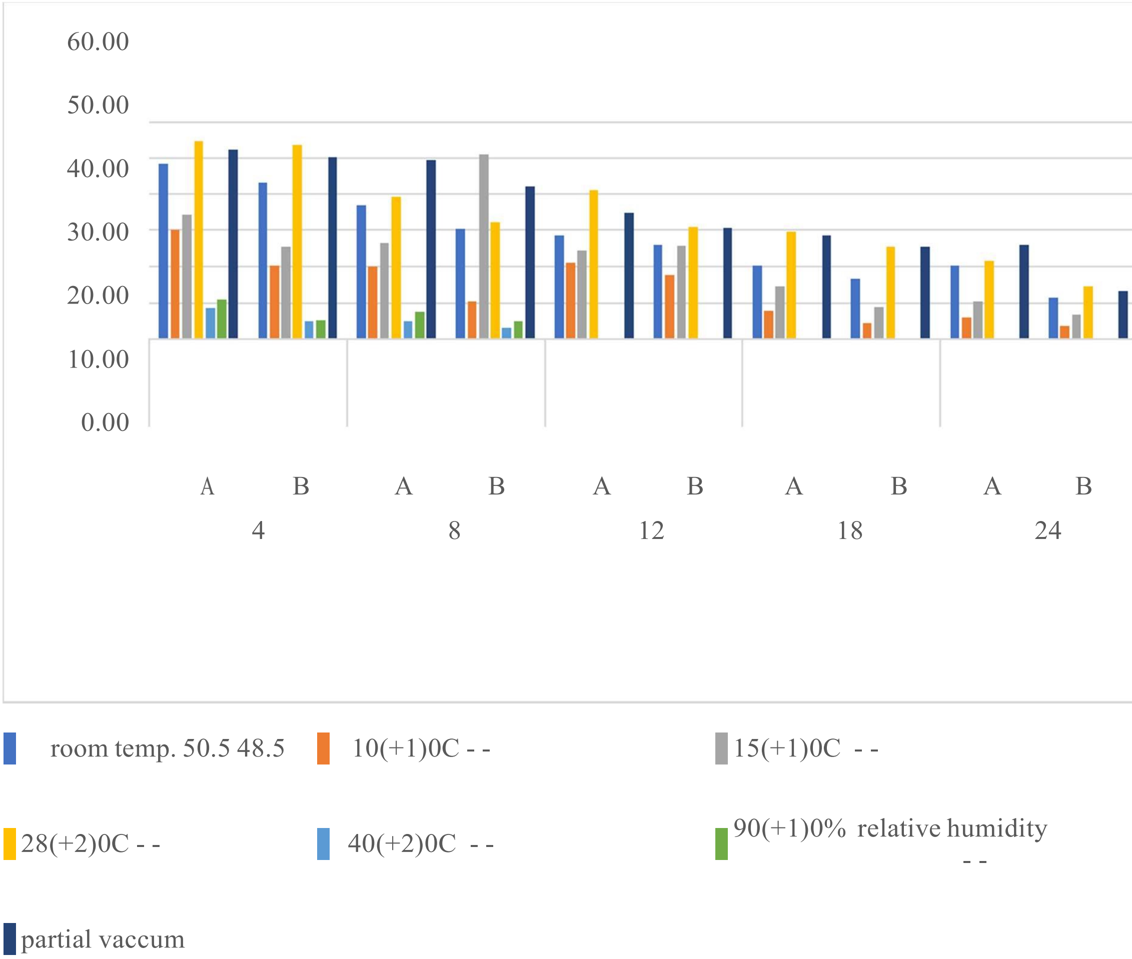
It is now generally believed that the sole virtue of sealed storage is to preserve the moisture content and prevent contamination by fungi and other microorganisms. Results similar to present investigations were recorded by several workers Flood and Mackay (1972), Simak (1973), Bass (1973) and Asakawa (1978).

Table No. 1: Effect of different storage condition and period on seed germination of*Andrographis paniculata*

Storage conditions	Storage period (inmonths)											
	Fresh Seed		4		8		12		18		24	
	A	B	A	B	A	B	A	B	A	B	A	B
room temp.	50.5	48.5	48.50	43.20	37.00	30.50	28.50	26.00	20.20	16.60	20.21	11.40
10(±1)^{0}C	-	-	30.00	20.20	20.00	10.50	21.00	17.60	7.77	4.43	6.00	3.60
15(±1)^{0}C	-	-	34.40	25.50	26.50	51.11	24.50	25.72	14.50	9.00	10.50	6.90
28(±2) ^{0}C	-	-	54.59	53.53	39.20	32.13	41.11	30.95	29.50	25.40	21.50	14.62
40(±2)^{0}C	-	-	8.50	5.00	5.00	3.20	-	-	-	-	-	-
90(±1)^0% relative humidity	-	-	10.90	5.35	7.50	5.00	-	-	-	-	-	-
partial vacuum			52.30	50.2	49.6	42.20	34.7	30.8	28.59	25.5	26	13.2

A represent germination percent. B represent plant percent.

Fig. No. 1: Effect of different storage condition and period on seed germination of *Andrographis paniculata.*



This gradual decline in viability/germination of seeds with increase in the period of storage may be ascribed to degeneration of enzymes, decrease of stored food. Gradual coagulation of protein of the embryos and accumulation of toxic metabolic physiological processes.

Moisture content of seeds of medicinal plant species stored up to 18 months period in three storage conditions viz. polythene bags, gunny bags and cloth bags. It shows that in plant species storage period and storage conditions are significant. The moisture curves of all the species are presented. The terminal values for moisture content of species. As per storage condition highest moisture up to a period of 24 months was retained in polythene bags following by cloth bags and gunny bags.

Table No. 2:
Effect of seed dimension and weight on germination percent of fresh seeds of *Andrographis paniculata*

Seed weight (mg)	G%	Seed length (mm)	G%
0.50-0.75	40.00	0.50-0.75	41
0.75-1.00	49.6	0.75-1.00	43
1.00-1.25	60.3	1.00-1.25	59.9
1.25-1.50	58.4	1.25-1.50	57.3

G% Germination Percent

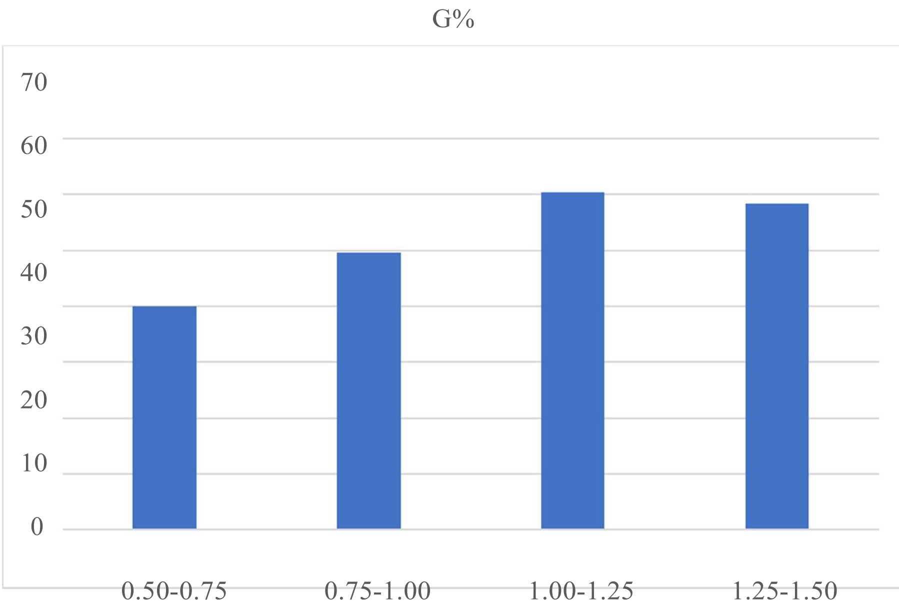


Fig. No. 2.

Data on the effect of seed dimensions and weight on percentage germination Table 2 and 2 fig. indicate a positive relationship between the percent germination and seed weight. The heavier seeds possessed higher percent germination in medicinal plant species. The same trend was also observed in relation to seed width. The narrow seeds possessed least germination percentage while the wider seeds showed highest percent germination.

Similar trend was noticed with increase in thickness of seeds Yadav *et al*. (1988) obtained similar relationship of seed germination with the size index or shape index of seeds. Similar relationship was observed by Kandya (1990) in *Cassia glauca*. Sometimes seed morphological characteristics have been found to indicate seed polymorphism and different form of seed were successfully and strongly related with the germination characteristics. Pathak *et al*. (1974) also found such relationships in *Leucaena leucocephala*. It has been reported by Prasad and Kandya (1991) that partial emptiness in seeds is responsible for the inability of germination in a large number of seeds of several species. It is suggested by Kandya (1978) that such seeds have very little nutritive tissue like endosperm.

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