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Studies of seed germination of *Anogeissus pendula*

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Abstract:

A thorough knowledge of behaviour of tree seed is required, not only for successful propagation of trees in nurseries for afforestation and reforestation purposes but also for the intelligent control of forestry operations aiming to assure natural reproduction. In the present study seed germination in *Anogeissus pendula* Edgew. a member of the family Combretaceae, under laboratory conditions has been investigated. Viability of seeds was assessed by TTC test. To enhance germination, seeds were treated with physical agents, chemicals and growth regulators. Seed germination percentage of *A. pendula* was also recorded for consecutive four years.

***Keywords*:** germination, Viability, afforestation, growth regulators etc.

Introduction

Tree seeds, unlike agricultural seeds, are in many cases characterised by many germination problems and thus, need several pre-treatments to overcome the germination problems and hastening the germination of seeds. The hastening of germination of forest tree seeds by artificial means is considerable importance in seed-testing and nursery practice. The ecological conditions prevailing in given habitat will affect germination, the determining factors being probably the microclimatic conditions prevailing in the immediate vicinity of the seed. Although, seed size and shape of a species show a remarkable consistency and are genetically determined nevertheless somatic polymorphism is quite common. In polymorphic seeds, produced in the same plant, different ecological factors and differences in dormancy and in germination behaviour are often associated with different seed forms. These differences in seed shape, size or weight may ensure difference in seed distribution in space and germination patterns. In other cases, the polymorphism is probably due simply to the shedding of the seeds

at different stages of the development which may result in differences in requirements for after-ripening and therefore of the time of germination. The size, shape, structure and composition of seeds can determine their germination behaviour in different environment. The development, maturation and drying of seeds is a complex process. However, it is considered that some conditions which prevail during seed development influence its subsequent germination behaviour. Seeds of *A. pendula* are winged with a terminating beak. Length of beak is equal or larger than the seed length.Average weight of *A. pendula* seed was slightly above 6.0 mg. However, the weight ranged from minimum 1.0 to maximum 17 mg depending upon the size and volume.

Seeds of Anogeissus pendula

Material and Methods

Seeds of *Anogeissus pendula* were collected from different sites located in Jaipur, Sirohi and Karauli districts of Rajasthan. After preliminary selection for uniformity (criteria being the size of seeds), the seeds were surface sterilized with 0.1% $HgCl_2$ for two minutes and thereafter repeatedly washed with distilled water (Mishra, 1968). After sterilization of seeds, they were subjected to various chemical and physical treatments.

1. PHYSICAL TREATMENTS

For physical treatments, seeds were treated with the following physical factors before laying for germination in laboratory conditions in Petri plates with layering of filter papers. Before physical treatments, the seeds were soacked in distilled water for 24 hrs. Three replicates of 10 seeds were used in each treatment.

i)Temperature

The soaked seeds were kept in Petri plates over filter paper, kept moist by distilled water. These were then exposed to 0, 10, 20, 30, 40 and 50^{o}C temperatures for 24 hrs. 0^{o}C temperature was set in freezer. The temperature range between 10-50^{o}C were set in a B.O.D. incubator. The seeds at room temperature were taken as control.

ii) Light quality

The source of continuous light was two tube lights of 40 watts, each set at a distance of 60.0 cm from the Petri plates. Different wavelengths, i.e. dark, green, red, blue and yellow were produced by wrapping the Petri plates with double cellophane papers of the respective colours. Unwrapped Petri plate was considered as control. Petri plates were then kept under a light source for 15 days.

iii) UV radiation

The source of ultra violet rays was a Philips ultraviolet tube light of TUV 30 W with wavelength of 2537A^{o}. Irradiation was made from a distance of 30.0 cm from the source for 5, 10, 15, 20, 25 and 30 minutes after which the Petri plates containing seeds were kept in dark for 24 hrs to prevent any photoreactivation.

2. CHEMICAL TREATMENTS

Following chemicals were used for presoaking.

i) Inorganic chemicals: Zinc Sulphate ($ZnSO_4$), Copper Sulphate ($CuSO_4$),

Ferrous Sulphate ($FeSO_4$), Boric Acid (H_3BO_3), Manganese Sulphate ($MnSO_4$)

and Sodium Sulphate (Na_2SO_4).

ii) Growth regulators:

Indole Butyric Acid (IBA), Gibberellic Acid (GA_3), 6 Benzylaminopurine (BAP), 1-Naphthalene Acetic Acid (NAA), 2,4Dichlorophenoxy Acetic Acid (2,4-D) and Kinetin were used. Seeds were soaked for 24 hrs in aqueous solutions of different concentrations of the chemicals mentioned above. The concentrations used were 50, 100, 200, 500 and 1000 ppm. Soaked seeds were washed thoroughly in distilled water. Seeds soaked in distilled water for 24 hrs were taken as control in all the treatments. Treated seeds were then kept for germination in

Petri plates over filter paper, kept moist by distilled water. Three replicates each with 10 seeds were used for each concentrations of each chemical. The experiments were performed under laboratory conditions. After pretreatments of seeds, they were allowed to germinate in Petri plates on wet filter papers for 15 days. These all treatments were given after H_2SO_4 scarification also. On the day of termination (16^{th} day) of experiment, number of seed germinated were recorded.

OBSERVATIONS

1.Effect of physical factors on seed germination and seedling growth

i) Effect of Temperature

No seed germination was observed at any temperature treatment

ii) Effect of light quality

No seed germination was observed at any light colour treatment.

iii) Effect of ultraviolet radiation

No seed germination was observed at any UV radiation treatment.

2. Effect of chemical treatments on seed germi-nation and seedling growth

i) Effect of inorganic chemicals

Results of all inorganic chemicals were found nil for seed germination of *Anogeissus pendula* in present study.

ii) Effect of growth regulators

Results of all growth regulators were found nil for seed germination of *A. pendula* in present study. Although, all of these treatments (physical as well as chemical) were given after H_2SO_4 scarification but there also no results were found for seed germination. These all treatments were given to seeds for three consecutive years i.e. from 2010 to 2013. With both old seeds as well as the duly collected seeds for the same year from different experimental sites. Therefore, we can say that either the seeds have very long dormancy period or they can not germinate due to any physiological phenomena. Observations at experimental sites, we can assume that production of large quantity/number of seeds is the main reason of very low seed germination in this plant since, unfertile seeds may have been produced due to excessive seed abortion or

failure of fertilization. Physical and biotic factors also responsible for low germination capacity of *A. pendula.* There were no flowering and fruiting observed at study sites due to low rain fall.

RESULT AND DISCUSSION

Seeds of *Anogeissus pendula* can germinate better *in vivo* then *in vitro*. It is difficult to germinate these seeds under laboratory conditions. Seed dormancy is the incapability of a viable seed to germinate under favourable conditions (Bewley, 1997) The seeds of many plant species do not germinate just after shedding from the parent plant. These seeds germinate under natural conditions if they remain as such in field for a certain period of time i.e. after-ripening. During this period several changes occur in the seeds by which they can germinate. These seeds can be stored for a period of four years although the viability is reduced. After-ripening often occurs during dry storage. The length of the storage period is variable. The necessity of after-ripening period may be due to either of an immature embryo or due to some biochemical changes in the seed (Crocker, 1916 and Kumar, 2014).

Baskin and Baskin (2004) reported that seeds of *Emex* species possess double dormancy mechanism. Seeds with embryos that are undifferentiated or under developed at shedding and require time for further development before germination are considered morphologically dormant. Physiological dormancy is characterized by low growth potential of embryos or the inability of embryos to rupture covering structures such as testa, endosperm, perisperm and pericarp. Combinations of morphological and physiological dormancy have been reported.

Production of unfertile seeds seems to be a major factor, which could be responsible for the poor germination percentage in *Anogeissus pendula*. Unfertile seeds may have been produced due to excessive seed abortion or failure of fertilization. Both, climatic and biotic factors play equally important role in the development process of *A. pendula* seeds (Saxena, 1989). Mathur (1956) reported that the germination capacity of *A. pendula* is very low (2-9 %).

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