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STUDIES ON PHYSIOLOGY OF SEED GERMINATION OF *MALVASTRUM COROMANDELIANUM* (L) GARCKE IN REWA, MADHYA PRADESH

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ABSTRACT

In the germination process, the seed's role is that of a reproductive unit; it is the thread of life that assures survival of all plant species. Furthermore, because of its role in stand establishment, seed germination remains a key to modern agriculture. Thus, especially in a world acutely aware of the delicate balance between food production and world population, a fundamental understanding of germination is essential to crop production. Based on the fate of the cotyledons, two kinds of seed germination occur, and neither appears to be related to seed structure. These two types are illustrated by the germination of bean and pea seeds. Although these seeds are similar in structure and are in the same taxonomic family, their germination patterns are quite different. This paper presents a study on physiology of seed germination of *Malvastrum coromandelianum* (L) Garcke in Rewa, Madhya Pradesh.

KEYWORDS: *Malvastrum coromandelianum,* seed germination, physiology etc.

INTRODUCTION

Germination is defined as the emergence of the radical through the seed coat. Such a definition says nothing about other essential structures such as the epicotyls or hypocotyls that become the above ground parts of a successful seedling. To the seed analyst, germination is "the emergence and development from the seed embryo of those essential structures which, for the kind of seed in question, are indicative of the ability to produce a normal plant under favorable conditions." This definition focuses on the reproductive ability of the seed, an essential objective in agriculture.[1, 2]

Water is a basic requirement for germination. It is essential for enzyme activation, breakdown, translocation, and use of reserve storage material. In their resting state, seeds are characteristically low in moisture and relatively inactive metabolically. Field capacity moisture is about optimum for germination in soil; however, germination varies among species and may occur at soil moistures near the permanent wilting point. Air is composed of about 20% oxygen, 0.03% carbon dioxide, and about 80% nitrogen gas. If one provides different proportions of each of these gases under experimental conditions, it soon becomes clear that oxygen is required for germination of most species. Carbon dioxide concentrations higher than 0.03% retard germination, while nitrogen gas has no influence. Seed germination is a complex process involving many individual reactions and phases, each of which is affected by temperature.[3,4,5]

Malvastrum coromandelianum (L) Garcke (family *Malvaceae*) is commonly known as false mallow, broom weed and clock plant. Various parts of this plant are used by numerous tribal populations throughout the world. Mexican Kickapoo Indians use the crushed leaves of this herb along with salt or alcohol to cure ringworm infection. Bhil tribes of Rajasthan use this plant in the form of decoction to cure jaundice. In Mexico leaf infusion of this plant is used to cure diabetes. In traditional Indian system of medicine the plant is reported as an anti-inflammatory, analgesic, and antidysenteric. Pharmacological screening showed various activities for this plant like antinociceptive, anti-inflammatory, and analgesic activity, and antimicrobial activity. *Malvastrum coromandelianum* is used in traditional medicine as an anti-inflammatory, analgesic, antidysenteric plant. Various extracts of the aerial parts of *Malvastrum coromandelianum* showed antinociceptive activity.[6,7]

Genus *Malvastrum* derives its name from Malva-the Mallow, and 'adinstar'-like. It belongs to the family Malvaceae and closely resembles to genus Sida Linn of the same family. The former genus can easily be distinguished from the latter by the presence of three bracteoles. The species has been described as a species of coromandelianum Linn, Malva -M. genus (Flora of Madras). According to Hooker's Flora of British India (1872), genus Malvastrum Gray includes about 100 species, in which, only two species are found in India. They are: *Malvastrum coromandelianum*, (Linn) Garcke and *Malvastrum spicatum*. *Malvastrum coromandelianum* possess three small projecting cusps on its carpels. On the basis of these cusps, it is distinguished from *Malvastrum spicatum* easily.[8.9]

Malvastrum coromandelianum is an erect, woody, perennial, branched herb or under shrub of the family Malvaceae. Local name of the species is 'Bariara'. Generally it is 60-90 cm high but sometimes it has got about 120 cm high. The plant is common weed of gardens, a cultivated fields and waste lands. The species is also recorded on disturbed grounds, such as, cleared areas in forest, uncultivated fields, path and road sides etc. The plants grow in open, partial shaded and shaded places, in grazed and ungrazed areas. The partial shaded and shaded plants are more erect, robust, less branched and late flowering; while, the plants growing on open and sunny areas are spreading *r*- stunted much branched and early flowering. The plants, however, prefer to grow on soils mixed with pieces of stone or brick, although, at such places, their growth is never luxuriant. Their maximum growth, however, can only be seen at places that suffer the least from biotic disturbances. The species of this plant occasionally seen in grassland and forest communities.[10,11,12]

MATERIAL AND METHODS

Physiology of Seed Germination

The seeds of the plant M. coromandelianum were collected from different localities for germination studies during the years 2010-2011. The seeds were preserved in glass stopped bottles after getting cleaned and air dried, in a cool dry place at room temperature. Germination experiments were carried out extensively during the year 2010-2011. Germination of seeds was tried in between the moist filter papers place on moist cotton pads inside sterilized petridishes. The filter papers were kept moist by periodical addition of distilled water. Emergence of the radical from the seed coat was taken as a criterion to decide whether the seed has germinated.

Dormancy Studies: Freshly harvested seeds were used for the purpose of dormancy studies. Non germ inability of the freshly collected seeds under favorable external conditions was considered as an indication of dormancy phenomenon in the seeds. Various physical and chemical treatments were done to overcome seed dormancy.

Methods of Breaking Dormancy and Seed Germination: The following methods were given to break the dormancy of seeds and also observed the seed germination of M. coromandelianum.

(i) Mechanical Scarification

In the present study, mechanical scarification was carried out by sand pounding method during 3 main seasons viz. rainy, winter and summer. 100, healthy seeds were taken in a

mortar and pestle along with some quantity of fine grained sand. The sand pounding was done gently for about 5 to 10 minutes, and then these seed were soaked in water for 24 hours. After soaking treatment, the seeds were transferred to petridishes and kept for germination at room temperature along with a control.

(ii) Temperature Treatment

To study the effect of temperature on breaking of the dormancy of seeds, different were given. 50 seeds were selected for each set and presoaked in water inside the petridishes for 24 hours. Then these seeds were incubated at different temperatures from 25^0C to 60^0C for 12 hours. After this treatment, seeds were set for germination.

(iii) Cold Water Treatment

Seeds were soaked in the room temperature for different time periods in cold water and germination response was calculated during the months of November-December or winter season.

(iv) Hot water Treatment

Selected seeds were treated with different temperatures in hot water for five minutes. Under different temperatures of water, germination response was calculated during the months of November-December (winter season).

(v) Effect of alternate temperature treatment

Selected 50 seeds for each set were kept at low and high temperatures alternatively to study the effect of these temperatures on breaking of dormancy.

(vi) Effect of ultraviolet radiations

Selected seeds for each set were kept at ultraviolet radiations alternatively to study the effect of these effects on breaking of dormancy.

RESULTS AND DISCUSSIONS

Water uptake of Seed and Seedling

Seed germination and seedling formation are the initial stage in the developmental history of the plant. Dry seeds contain less than 5-10 % of water. This is the cause of extremely low rate of metabolism in such seeds. When seeds come in contact with water it imbibes a relationship exists between germination of seeds and water potential. Seeds were weighed before soaking

in water, and again after soaking in water, in different hours of days. Difference of the two weights gives the amount of water absorbed by the seeds and seedlings.

Physiology of seed germination

Seeds are the first link in the food chain and are sustaining the life on the earth through their viability and nutritive values. For 5000 years, peasants have produced their own seeds, selecting, storing, sowing, and letting nature takes place its own course in the food chain. Morphologically the seed consist of an embryo surrounded by testa. The seed could carry much larger food reserves than stores and being multicellular lends itself to elaborate adaptation giving better dispersal.

Effect of Mechanical Scarification on Germination Percentage of *Malvastrum coromandelianum* Seeds in Different Seasons

Mechanical scarification was carried out by sand pounding P1 method during 3 main seasons viz. rainy, winter and summer.

Observation

The results of the experiment, which are tabulated in table-1 show that seeds show higher percentage of germination i.e. 100%, 98% and 90% in rainy, summer and winter seasons respectively. It was also observed that sand pounding method helps more in the breakdown of dormancy of seeds during winter season.

Effect of temperature treatment on seed germination

Seeds of *Malvastrum coromandelianum* were collected during winter season and incubated at different temperatures. These seeds then kept in petridishes for germination to study the effect of temperature on breaking of the dormancy of seeds. The results are given in table-2. It was observed that the maximum germination percentage at 40^0C. The germination percentage increases with increasing temperature up to 40^0C but it decreases when temperature increasing from 40^0c. There is no germination at 60^0C.

Cold water treatment

To study the effect of cold water treatment on breaking of the seed dormancy, 50 seeds (for each set) were soaked in cold water for different time periods and set for germination. The results are tabulated in table-3. It shows that seeds of *Malvastrum coromandelianum* go on losing their germ inability with the increasing period of cold water treatment.

Effect of hot water Treatment

To study the effect of hot water treatment on breaking of dormancy, 50 seeds were soaked in different temperatures of water and results are given in table-4. It was observed that seeds soaked in hot water show maximum germination at 40^0c. During hot water treatment, germination observed up to 80^0c. There is no germination at 90^0c and 100^0c.

Effect of alternate temperature treatment

Selected 50 seeds for each set were kept at low and high temperatures alternatively to study the effect of these temperatures on breaking of dormancy. The data in table 5 show that the alternate temperature treatment is quite effective in increasing the germination percentage of seeds. The best duration for such a treatment, however, is limited to 12 hours storage in refrigerator at 5-7^0c and 12 hours in oven at 100^0C, after which the percentage germination becomes very low.

Effect of ultraviolet radiations

It was observed that the ultraviolet rays do not help in removing the dormancy of seeds rather they inhibit the germination of seeds of *Malvastrum coromandelianum* completely. (table-6)

Table-1 Effect of mechanical scarification on germination % of *Malvastrum coromandelianum* seeds in different seasons

S. No.	Name of the season	Mechanical scarification, given/ not given	Germination % in 20 days
1	Control	-	60
2	Rainy season	Not given Given	85 100
3	Winter season	Not given Given	10 90
4	Summer season	Not given Given	24 98

Table-2 Effect of temperature treatment at 12 hours on the seed germination of *Malvastrum coromandelianum*

S. No.	Temperature treatment	Germination % in 20 days
1	Control	60
2	25°C	10
3	30 °C	12
4	35 °C	16
5	40 °C	20
6	45 °C	14
7	50 °C	11
8	55 °C	04
9	60 °C	Nil

Table-3 Effect of cold water treatment on the seed germination of *Malvastrum coromandelianum*

S. No.	Duration in hours	Germination % in 20 days
1	Control	60
2	6	18
3	12	17
4	18	16
5	24	12
6	30	10
7	36	6
8	42	4
9	48	Nil

Table-4 Effect of hot water treatment on the seed germination of *Malvastrum coromandelianum*

S. No.	Water treatment	Germination % in 20 days
1	Control	60
2	0 ^{o}C	Nil
3	20 ^{o}C	2
4	30 ^{o}C	8
5	40 ^{o}C	22
6	50 ^{o}C	16
7	60 ^{o}C	4
8	70 ^{o}C	2
9	80 ^{o}C	2
10	90 ^{o}C	Nil
11	100 ^{o}C	Nil

Table-5 Effect of alternate temperature treatment on germination% of *Malvastrum coromandelianum*

S. No.	Duration of treatment given in hours	Germination % in 20 days
1	Control	60
2	6 h refrigerator (5-7 ^{o}C) and 6 h in oven (100 ^{o}C)	48
3	12 h refrigerator (5-7 ^{o}C) and 12 h in oven (100 ^{o}C)	69
4	24 h refrigerator (5-7 ^{o}C) and 24 h in oven (100 ^{o}C)	36
5	48 h refrigerator (5-7 ^{o}C) and 48 h in oven (100 ^{o}C)	6

Table-6 Effect of ultraviolet rays treatment on germination% of *Malvastrum coromandelianum*

S. No.	Ultraviolet rays given (in minutes)	Germination % in 20 days
1	Control	60
2	2	Nil
3	4	Nil
4	6	Nil
5	8	Nil
6	10	Nil
7	12	Nil

CONCLUSION

The seed germination in *Malvastrum coromandelianum* is due to the impermeability of hard seed coat. In rainy season, normal germination was observed but after mechanical treatment the germination percent enhanced and reached up to 100%. Likewise in the winter and summer season the seeds show poor percentage of germination but after mechanical treatment the germination percentage enhanced up to 90% and 98%.

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