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Moringa concanensis- Variation in seed size and germination in diverse localities seedlots from Rajasthan

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ABSTRACT

Moringa concanensis belong to family Moringaceae (Drumstick family) is a small tree with various indigenous medicinal value in different parts of India especially in tribal parts of Southern region. In Rajathan, it is reported is Jodhpur (Dechu), Barmer (rocky area) (Bhandari, 1990), Churu (Gopalpura), Jhalawar (Khanpur), Jaisalmer (Near Kuri), Pali (Piproli) and Tonk (Mayola forest). It is a rare plant in Rajasthan. In the present study, seedlots collected from different locations were tested with various treatment to understand its germination behaviour along with relation of seed size with germination percentage and other factors.

Keywords: *Moringa concanensis*; Drumstick; Germination percentage; Mean germination time; Germination value; Mental alertness; Healthy skin; Ascorbic acid; Myristic acid; Palmitic acid.

1. Introduction

Genus Moringa is represented by 13 species all are the world (Mabberley, 2008). Among these two species namely *Moringa oleifera* lam and *Moringa concanensis* Nimmo ex. Dalzell and Gibson are found in India (Hooker, 1879). *Moringa concanensis* Nimmo belong to family Moringaceae is one of the important medicinal plant.

M. concanensis is highly endangered multipurpose tree species which is known by different common names in different parts of India. It is known as Nugge, Kaadu, nugge in Kannada, Muringa in Malayalam, mashinga in Marathi, in sankrit is known as Aksiva, bahulada and bahupatarka, in tamil it is known by name as kattu murungai.

Moringa concanensis belong to family Moringaceae (Drumstick family). It is a small tree with thick bark. Tree is hairless except younger parts and inflorescence. Its leaves are bipinnate (very rarely tripinnate) and about 45 cm long. Its flowers are small yellowish with red or pink veins flowering takes places from October to March. Its fruits are pod which 30-45 cm long seed are white or pale yellow with 3-angled.

Its distribution is reported in Pakistan, Asia Minor, Africa and Arabia (Mughal et al., 1999). In India, it is reported in Hilly region of Eastern Ghats (Pullaiah & Chennaiah, 1997) and Western Ghats (Prasanna, 2000). In Rajathan it is reported in Jodhpur (Dechu), Barmer (rocky area) (Bhandari, 1990), Churu (Gopalpura), Jhalawar (Khanpur), Jaisalmer (Near Kuri), Pali (Piproli) and Tonk (Mayola forest) [reported by Shetty & Singh, 1988]. Some research reported confirmed this in Barmer, Jodhpur, Jaisalmer, Nagaur, Pali, Bundi,Jhalawar, Jalore (reported by Kumar & Purohit, 2015). It is a rare plant in Rajasthan, Generic epithet 'Moringa' alludes to the tamil word 'murungai' means drumstick i.e. fruit called drumstick. Specific 'concanensis' derived from two word 'concan' means a place Konkan region of Maharashtra and 'sis' means in honour of i.e. the name given on honour of konkan region. Grahm (1839) reported that “A new species discovered by Nimmo in the South Concan.” But it was without description. Later Deshpande et al. (2019) has done lectotype of *Moringa concanensis.*

Moringa concanensis is known by different names in other countries in Sindi as Mooah, in Cameroon as Paizlava, chabana and Naanko, in chand as Kagn' dongue, in Ethoipia as shelagda, in kenya as Mronge, in Zimbabwe mupulanga and zakalanda and in Burma as Dandsalobin.

Genus Moringa has 13 species and they are found in different parts of world. *Moringa drochardii* lum in Medagaskar, *M. hiddebrandtii* in Medagaskar, *M. Ovalifolia* Dinter and *A. Burger* in Namibia and South west Angola, *M. stenopetala* (Baker f.) cufod in Kenya and Ethopia, *M. peregrine* (Foessk) fiori in Red sea, Arabia, Horn of Africa etc. *M. arborea* verdc in North Eastern Kenya, *M. borziana* mattei in Kenya and Somalia, *M. longituba* Engl in karya, Ethopia and Somalia, *M. pygmaea* Verde, in North Somalia, *M. rivae* chior in Kenya and Ethopia and *M. ruspoliane* Eyl in Kenya, Ethopia and Somalia. Besides these *Moringe oleifera* Lam and *M. concanensis* Nimro is found in India.

1.1. Study Objective

The main objective of study is to find out variation in seed size and other parameters in *Moringa concanensis* collected from different regions and also to find out best treatment for its germination alongwith other parameters so that quality seedlings can be produced in nursery which perform better in the field.

1.2. Uses

The indigenous Knowledge and use of Moringa has been used by various societies including the Roman, Greek, Egypt, India and many others for thousands of years with writing dating as far back as 150 AD. The history of Moringa dates back to 150 B.C. where ancient Kings and queen used Moringa leaves and fruit in their diet to maintain mental alertness and healthy skin. Ancient Maurian warriors of India were fed with Moringa leaf extract in the warfront. The Ellixir drink was believed to add them extra energy and relieve them of the stress and pain incurred during war.

The Moringa species are currently of wide interest because of their outstanding economic potential. Amongst these species *Moringa oleifera* is most prevalent for its nutritious and numerous medicinal uses that have been appreciated for countries in many parts of its native and introduced ranges. In recent past few other species viz. *M. stenopetala*, *M. peregrine* and *M. concanensis* have been discovered to be having equal potential such as nutritious vegetables, high quality seed oil, antibiotics and water clarification agents like *M. oleifera*.

Moringa concanensis Nimmo locally known as Kattumurungal by tribal people of Nilgiries in the region of the Tamilnadu state. It is widely used as anti-fertility agent for decades by tribals of Nilgiri hills region. The tribals of Nilgiries; the hill region of western Ghats in Tamilnadu were known to practice traditional medicine and our interaction with these tribals have given as the leads to several researchers related with the possible presence of a therapeutic rationale in their claims. Most of the researchers show that the presence of the ascorbic acid, myristic acid, palmitic acid, oleic acid, stearic acid, arachidic acid and linoleic acid from the fruits of *Moringa concanensis* and seed respectively.

Moringa concanensis is cultivated in tropical dry regions of India. It is majorly cultivated in western and Southern regions of India. This plant is not edible because of its bitter taste but it has a variety of uses due to its chemical

composition. It is traditionally used as anti fertility agent in tribal area (https./www.flower of India.net). Several uses of *M. Concanensis* in Tamilnadu are described with disease cured, parts used, mode of drug preparation and method of consumption. Its fresh leaves juice is taken in morning empty stomach to reduce cholesterol and body weight. Its leaves are cooled as vegetable will produce cooling effect of eyes and prevent sore eyes.

Its fresh flower juice taken twice a day for 30 day help especially in women. Its leaves were also useful in fertility in women. Decoction of leaves taken in empty stomach for 80 days gives aphrodisiac effect. The leaves decoction with sugar in early morning for 7 day help in relief from tiredness. Leaves of *M. concanensis* with 1gm of *Piper nigrum* were boiled and filtered are taken in early morning reduces blood pressure. Its flower juice is used in abortion. Leaves also helpful in menstrual pain, jaundice, constipation ete. Its seeds powdered and taken internally useful in killing intestinal worms. Leaves decoction useful in reducing diabetes. It's gum mixed with milk and applied over forehead reduce headache. Its roots are cut & boiled taken twice a day helpful in reducing spinal cord pain (Kiritikar & Basu, 1984; Pushpagandan & Atal, 1984).

1.3. Comparative analysis between *M. oleifera* and *M. concanensis*

Characters	***M. oleifera***	***M. concanensis***
Pod length (cm)	34.86 (29-41.1)	29.11 (27-31.5)
Pod width (cm)	1.82 (1.7-1.9)	1.73 (1.3-1.9)
No. of seeds in a pod	11-16	15-20
Seed length (mm)	11.43 (8.7-14.1)	9.76 (6.6-12.1)
Seed width (mm)	9.26 (7.4-10.8)	8.28 (7.7-8.6)
Seed weight (gm)	0.25	0.13

Moringa cocanensis nutritional profile reveals that it contains terpenoids, steroids, cardiac flycosides, alkaloids, tannins, phenols, carbohydrates and protein. Its nutritional profiling show it is rich in vitamin like vitamin C, vitamin E, vitamin K and minerals like calcium, sodium, potassium and iron.

2. Material and Methods

Seeds of *Moringa concanensis* were collected and after proper cleaning and drying they were stored for further analysis. Seed length, width and thickness were recorded for 100 seeds of each seedlot. The seed germination tests were performed in seed germination Laboratory of Silviculture and Forest Management, ICFRE–Arid Forest Research Institute, Jodhpur. With the help of seed counter machine seeds per kilogram were calculated. Laboratory test on the germination response of seeds to pre-germination treatments of Hot water, GA_3 (500 and 1000 ppm) and IBA GA_3 (500 and 1000 ppm) compared to untreated seeds (control).

Soaking Hundred seeds in hot water for 15 min. Hundred seeds were also soaked in GA_3 (500 and 1000 ppm) and IBA GA_3 (500 and 1000 ppm) for 6 hours. All the pre- treated and untreated seeds were rinsed thoroughly in distilled water and were placed in germination tray. The experiment was carried out at room temperature in the

laboratory. Seeds were considered germinated upon plumule emergence. The number of seeds that germinated was recorded while the percentage seed germination was calculated. Following procedure was made for different parameters determinations:

2.1. Formulas for various calculations

(a) GP (Germination percentage) = (Total number of seeds germinated/total number of seeds tested) × 100

Final Germination Percentage (FGP %) = Final no. of seeds germinated in a seedlot × 100

The higher the FGP value, the greater the germination of a seed population (Scott et al. (1984)).

(b) MGT (Mean germination time) = total (daily germination) × 1 days/total seed sowing

Mean Germination Time (MGT day) =Σf ·x/Σf

f=Seeds germinated on day x

The lower the MGT, the faster a population of seeds has germinated (Orchard (1977)).

- First Day of Germination FDG day =Day on which the first germination event occurred

Lower FDG values indicate a faster initiation of germination (Kader (1998)).

- Last Day of Germination LDG day =Day on which the last germination event occurred Lower LDG values indicate a faster ending of germination (Kader (1998)).

- Germination Rate Index GRI (%/day) =G1/1 + G2/2 +· · ·+ Gx/x

G1=Germination percentage × 100 at the first day after sowing, G2=Germination percentage × 100 at the second day after sowing

(c) AVG MGT (Average Mean germination time) = Total MGT/Total number of days

(d) GV (Germination Value) = (Total MGT/total germination) × (GP%/10)

(e) AVG GV (Average Germination Value) = Total GV/Total number of days

3. Result

Seeds of *Moringa concanensis* were collected from 4 locations in different parts of Rajasthan viz. Churu, Kota, Udaipur and Mount Abu during 2023-24. Seeds were measured for their length and width which indicate that mean average seed length was in the range of 8.54 mm to 12.53 mm. It was minimum as 8.54 mm in seeds collected from forest nursery, Churu. While it was maximum as 12.53 mm in seeds collected from Chippaberi, Mount Abu.

Mean seed width was in the range of 6.13 mm to 10.04 mm. It was 6.13 mm in seeds of forest nursery, located at Churu. While it was 10.04 mm in seedlot of Kanwas, Darra, Kota.

Seeds were further tested for its germination percentage and they were treated with hot water, GA_3 500 ppm , GA_3 1000 ppm as well as control. In control treated seed germination was in the range of 40 percent (in Bhinder, Udaipur seedlots) to 70 percent (in both Kanwas, Darra, Kota and Chippaberi Mount Abu) seedlots.

In hot water treated seedlot germination percentage various growth. In forest nursery Churu it was found only 5 percent (2023 sample) while it was in the range of 60-80 percent in other three seedlots. It was maximum 80 percent in Chippaberi, Mount Abu seedlot.

In GA_3 treated seeds with GA_3 500 ppm germination percentage were in the range of 40 to 80 percent. It was only 40 percent in Bhinder, Udaipur and highest as 80 percent in Chippaberi, Mount Abu with GA_3 1000ppm treatment it was found in the range of 60 to 85 percent. It was highest as 85 percent in forest nursery, Churu seedlot.

Overall in laboratory conditions germination was in the range of 40 to 85 percent (except 5 percent in hot water treated seeds of forest nursery, Churu.

Total mean germination time was found in the range of 4.75 in forest nursery, Churu of hot water treated seeds to 93.85 in GA_3 1000 ppm treated seedlot of forest nursery, Churu. Total germination value was in the range of 23.25 (in forest nursery, Churu) in hot water treated seedlot while it was height was 1411 in Kanwas, Darra, Kota seedlot with GA_3 1000 ppm treated seedlot.

Average mean germination time was in the range of 0.32 (in hot water treated seedlot of forest nursery, Churu) to 6.26 in GA_3 1000 ppm treated seedlot of forest nursery, Churu seedlot. Average germination value was in the range of 1.58 in hot water treated seedlot of forest nursery, Churu to 108.40 in hot water treated seedlot of Bhindar, Udaipur.

4. Discussion

Variation in seed germination may be attributed to edaphic factor, climatic variation in that area as well as formation of empty embryo or less viable seeds.

With respect to seed size and germination percentage there was no direct linkage was found so mainly the local factors and climatic variation along with seed embryo formation is responsible for germination. A thorough study on reproductive biology and studies of its seed behaviour from all locations where it exists is needed for future research.

5. Conclusion

It is observed that except one forest nursery, Churu seedlot treated with hot water has very less germination value where as others have 40 to 85 percent germination indicating that particular sample either have more non viable seeds or due to hot treatment their seed vigor lost quickly. With GA_3 1000 ppm treated seedlots, germination was higher compare to control and other treatment so it is suggested that seeds of *Moringa concanensis* can be treated with GA_3 1000 ppm for better germination percentage.

6. Future Suggestion

It was found that dry region and semi arid or humid region have different seed size and germination also varies greatly in different seedlots. This may be due to edaphic and climatic variation as well as genetic makeup of different seedlots hence studies on its reproductive biology and further detailed studies on various seed sources with different agro climatic zones need to be studied.

Table 1. Effect of Seed Size and germination in *Moringa concanensis*

S.No.	Location	GPS	Date of Collection	Seed Analysis		Germination Percentage			
				Mean Length (mm)	Mean Width (mm)	Control	Hot Water	GA_3 500 PPM	GA_3 1000 PPM
1.	Forest Nursery, Behind DFO office, Churu	N28°29'21.36 E74°95'87.23	14-06-2023	8.54	6.13	65	5	65	85
2.	Kanwas, Darra, Kota	N 24°51.905 E 076°06.170	11-06-2024	12.21	10.04	70	70	80	80
3.	Bhindar, Udaipur	N 24.527894 E 074.199121	10-5-2024	12.38	9.89	40	60	40	60
4.	Chippaberi, Mt Abu, Sirohi	N 24°34.921' E 073°46.841'	26-06-2024	12.53	8.30	70	80	70	80

Table 2. Total MGT, Total GV, Average MGT and Average GV in Moringa *concanensis*

S.No.	Location	GPS	Date of Collection	Germination in Tray				
				Treatments	Total MGT	Total GV	Average MGT	Average GV
1.	Forest Nursery, Behind DFO office, Churu	N28°29'21.36 E74°95'87.23	14-06-2023	Control	71.25	506.76	4.75	33.78
				Hot Water	4.75	23.75	0.32	1.58
				GA_3 500 PPM	0	0	0	0
				GA_3 1000 PPM	93.85	635.44	6.26	42.36
2.	Kanwas, Darra, Kota	N 24°51.905 E 076°06.170	11-06-2024	Control	77.7	1048.95	5.18	69.93
				Hot Water	75.5	1093.49	5.03	72.90
				GA_3 500 PPM	88.7	1224.90	5.91	81.66
				GA_3 1000 PPM	85	1411	5.67	94.07
3.	Bhindar, Udaipur	N 24.527894 E 074.199121	10-5-2024	Control	35.2	633.6	2.35	42.24
				Hot Water	54.2	1626	3.61	108.40
				GA_3 500 PPM	33.4	668	2.23	44.53
				GA_3 1000 PPM	46.4	1160	3.09	77.33
4.	Chippaberi, Mt Abu, Sirohi	N 24°34.921' E 073°46.841'	26-06-2024	Control	76.3	1028.77	5.09	68.59
				Hot Water	87.1	1255.07	5.81	83.67
				GA_3 500 PPM	76.6	1064.74	5.11	70.98
				GA_3 1000 PPM	86.1	1371.86	5.74	91.46

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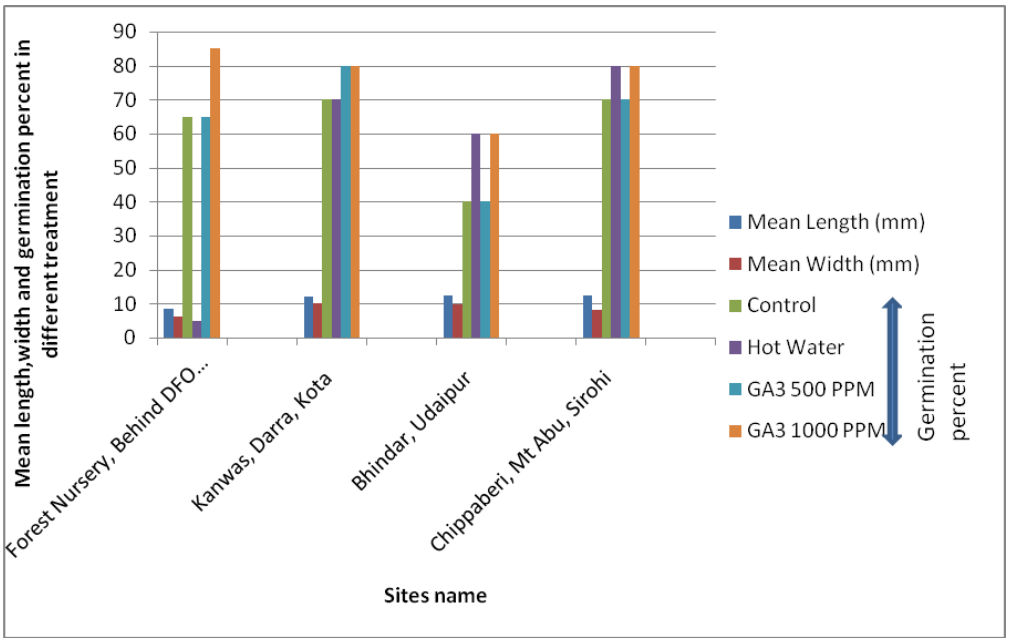

Figure 1. Effect of Seed Size on Germination in *Moringa concanensis*

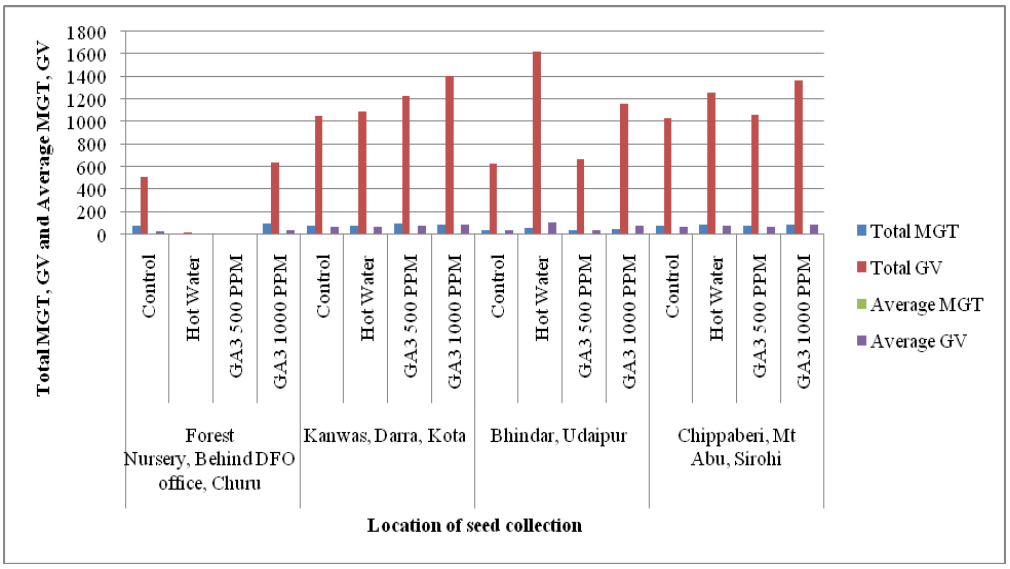

Figure 2. Total MGT, Total GV, Average MGT and Average GV of *Moringa concanensis*

Plate 1. Seed germination in Petriplates

Plate 2. Seed germination in tray

Declarations

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Competing Interests Statement

The authors declare no competing financial, professional, or personal interests.

Consent for Publication

The authors declare that they consented to the publication of this research work.

Authors' contributions

All the authors took part in literature review, analysis and manuscript writing equally.

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