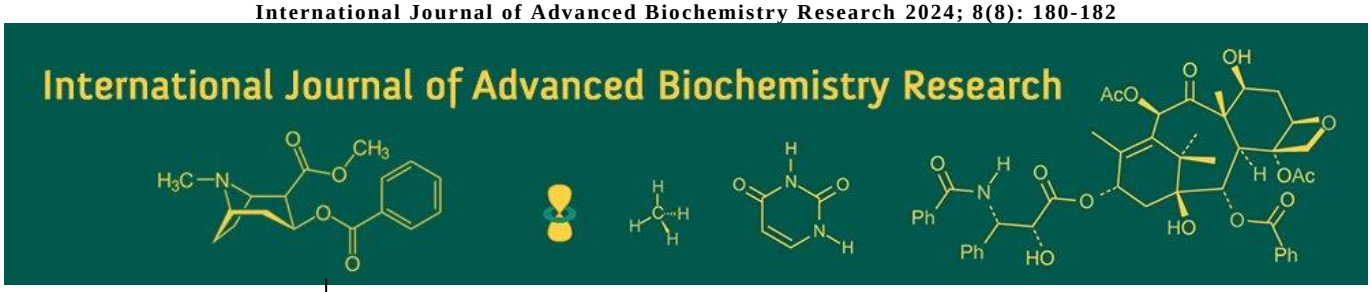

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Effect of different growing condition and seed treatment on germination of Bismarck palm (*Bismarckia nobilis*)

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Abstract
An experiment was conducted to study the effect of different growing condition and seed treatment on germination of Bismarck palm (*Bismarckia nobilis*)" during Kharif-2023 at Ornamental Nursery, College of Horticulture, Anand Agricultural University, Anand. The experiment was conducted using a completely randomized design with a factorial concept and three repetitions. The minimized time period for days taken for germination (62.59) and number of days taken to 50% germination percentage (GT_{50}) (71.15) and also increase germination percentage (67.07%), germination rate index (GRI) (93.20), corrected germination rate index (CGRI) (140.63) and final survival percentage (67.07%) were recorded significantly in green net poly tunnel as comparison to open condition. The minimum time period for days taken for germination (57.17), number of days taken to 50% germination percentage (GT_{50}) (64.67) and also increase germination percentage (85.00%), GRI (126.28), CGRI (159.50) and final survival percentage (85.00%) were recorded significantly in mechanically scarification. While, in interaction effect, minimum days taken for germination (56.67), number of days taken to 50% germination percentage (GT_{50}) (62.67) and maximum germination percentage (86.33) and final survival percentage (86.33) found with treatment combination of green net poly tunnel with mechanically scarification.

Keywords: GA_3, HNO_3, H_2SO_4, cow urine, Bio-NP, GRI, CGRI

1. Introduction
The Arecaceae family includes palm trees are economically importance both as a source of agricultural produce and as ornamental components in landscaping (Lossi *et al*., 2006) [3]. *Bismarckia nobilis* is native to Madagascar region with dry and hot climates and only one species within *Bismarckia* genus from Arecaceae family, although mentioned in the literature for many decades, this species has become much more understood over the past twenty years. Most palms take 100 days or more to germinate, with an average germination rate of less than 20%. There is great diversity in palm seed size (Jones 1995) [2]. Most of the seed tissue is endosperm, which provides food for the germinating embryo. Many palm seeds are extremely hard resulting in slow germination. Germination will vary from year to year and from region to region or even from plant to plant (Meerow 1991) [4].
The germination percentage may affect by growing condition i.e. open, shady, protected condition. As well as there are many treatments that routinely used to enhance germination percentages i.e. soaking in water for certain periods of time, scarification, stratification, removal of seed from the fruit to eliminate natural germination inhibitors and chemical enhancers such as gibberellic acid (GA_3).

2. Materials and Methods
The research experiment was carried out during Kharif-2023 at Ornamental Nursery, College of Horticulture, Anand Agricultural University, Anand. Bismarck seeds were collected in the month of June from nearby area of College of Horticulture, AAU from uniform growth, same age palm. All the collected seeds have diameter between 1.5-2.4 inch with 7-10 gm graded seed were selected for experiments. The experiment consists of two factors. Factor one was growing condition: G_1 – open condition, G_2 – green net poly tunnel and second factor

involved nine seed treatment : S_1 - Seed soaking in GA_3 @ 1000 mg/liter for 10 minutes, S_2 - Seed soaking in GA_3 @ 1500 mg/litre for 10 minutes, S_3 - Seed soaking in H_2SO_4 @ 50% for 30 minutes, S_4 - Seed soaking in HNO_3 @ 50% for 30 minutes, S_5 - Seed soaking in tap water for 7 days, S_6 - Seed soaking in cow urine @ 20% for 24 hours, S_7 - Mechanically scarification, S_8 - Bio-NP @ 10ml/1litre water (*Azotobacto*r + PSB) for 2 days and S_9 - Control (without seed treatment). Mechanical scarification treatment given by used of plastic container. This container filled with small brick piece and then hand rubbed seeds for 30 minutes. After that sown in black grow begs 9-inch size with used of soil, cocopeat and vermicompost (1: 1: 1). The experiment was conducted using a completely randomized design with a factorial concept and three repetitions. For taking different germination parameters among all twenty plants of three replications five plants were randomly tagged and all observation taken from tagged five plant and average was recorded.

3. Results and Discussion

3.1.1 Growing condition

The data presented in table 1 indicated that, the green net poly tunnel (G_2) recorded significantly minimum i.e. 62.59 days taken for germination. Whereas, in open condition (G_1), took maximum i.e. 66.59 days taken for germination. These result was in accordance with the finding by Mohanty *et al.* (2011) [5] in rose. Its might be due to higher temperature and humidity under green net poly tunnel than open condition and experiment taken during monsoon season, mist chamber like atmosphere created in poly tunnel resulted earlier germination.

The data presented in table 1 indicated that, the green net poly tunnel (G_2) recorded significantly maximum germination percentage (67.07%). Whereas, open condition (G_1) was significantly minimum germination percentage (61.11%). Similar result was reported by Saaie and Dadlani, (2002) [8] in gladiolus. Its might be due to rise in soil temperature inside the protected condition with more moisture retain as compared to open field condition which favors seed germination.

The data presented in table 1 indicate that, the significantly minimum i.e. 71.15 days taken to 50% germination percentage (GT_{50}) was recorded with green net poly tunnel (G_2). Whereas, the significantly maximum i.e. 76.85 days taken to 50% germination percentage (GT_{50}) was recorded with open condition (G_1)**.** Whereas**,** the significantly maximum germination rate index (GRI) (93.20) was recorded with green net poly tunnel (G_2). Whereas, the minimum germination rate index (GRI) (80.32) was registered with the open condition (G_1).

It reflects the proportion of assimilate distribution between germination rate index and final germination percentage. The maximum corrected germination rate index (CGRI) (140.63) was recorded with green net poly tunnel (G_2). Whereas, the minimum corrected germination rate index (CGRI) (135.85) was registered with the open condition (G_1). While, final survival percentage was found significant by growing condition. The maximum final survival percentage (67.07%) was recorded with green net poly tunnel (G_2). Whereas, the minimum final survival percentage (60.40%) was registered with the open condition (G_1). Similar result was reported by Mujib and Pal, (1995) [7] in carnation. This is might be due to green net poly tunnel provided congenial and suitable microclimate condition for establishment and further growth of the plantlets.

3.1.2 Seed treatment

The data presented in table 1 indicated that, the significant minimum days taken for germination (57.17) was recorded with mechanically scarification (S_7), which was at par with treatment S_2 (GA_3 @ 1500 mg/l) and S_1 (GA_3 @ 1000 mg/l). Whereas, significantly maximum days taken for germination (76.17) was recorded under control (S_9). Similar result was reported by Moussa *et al.* (1998) [6] in doum palm. The mechanically scarified seed improved germination of palm might be due to increasing permeability of water and air in the seed.

The data presented in Table 1 indicate that, the significantly maximum germination (85.00%) was found in mechanically scarification (S_7). Whereas, (Control) without seed treatment (S_9) recorded minimum germination percentage (61.11%). While, the significantly minimum days taken to 50% germination percentage (GT_{50}) (64.67) was recorded by mechanically scarification (S_7), which was at par with S_2 (GA_3 @ 1500 mg/l). Whereas, the significantly maximum days taken to 50% germination percentage (GT_{50}) (86.83) was noted in control (S_9).

The data presented in table 1 indicated that, the significantly maximum germination rate index (GRI) (126.28) was recorded with application of mechanically scarification (S_7). Whereas, the minimum germination rate index (GRI) (52.77) was registered with treatment of control (S_9). On other side the significantly maximum corrected germination rate index (CGRI) (159.50) was recorded with application of mechanically scarification (S_7). Whereas, the minimum corrected germination rate index (GRI) (122.07) was registered with treatment of Control (S_9) which was at par with treatment S_2 (H_2SO_4 @ 50% for 30 minutes).

The data presented in table 1 indicated that, the significantly maximum final survival percentage (85.00%) was recorded with application of mechanically scarification (S_7). Whereas, the minimum final survival percentage (46.67%) was registered with treatment of control (S_9). These findings align with the conclusions drawn by Corley and Tinker, (2003) [1] in oil palm. Its might be due to relationship between embryo development and imbibition of water in seed.

3.1.3 Interaction effect

The data presented in table 2 indicated that, the significantly minimum number of days taken for germination (56.67) was found in the treatment combination of green net poly tunnel with mechanically scarification (G_2S_7), which was at par with treatments G_1S_7, G_2S_2 and G_2S_1. Whereas, the maximum days taken for germination (82.33) was noted in treatment combination of open condition without seed treatment (control) (G_1S_9). While, the significantly maximum germination percentage (86.33%) was recorded in treatment green net poly tunnel with mechanically scarification (G_2S_7), which was at par with treatments G_1S_7. Whereas, the minimum germination percentage (41.67%) was recorded in treatment open condition without seed treatment (Control) (G_1S_9).

The data presented in table 2 indicated that, the significantly minimum days taken to 50% germination percentage (GT_{50}) (62.67) was recorded in treatment combination of green net poly tunnel with mechanically scarification (G_2S_7), which

was at par with treatment G_1S_7, G_2S_2 and G_2S_1. Whereas, the significantly maximum 93.67 days taken to 50% germination percentage (GT_{50}) was recorded in treatment open condition without seed treatment (control) (G_1S_9). The significantly maximum final survival percentage (86.33%) was recorded in treatment green net poly tunnel with mechanically scarification (G_2S_7), which was at par with treatment G_1S_7. Whereas, the minimum final survival percentage (41.67%) was recorded in treatment of open condition without seed treatment (Control) (G_1S_9).

Table 1: Effect of different growing condition and seed treatment on germination of Bismarck palm

Treatment	Days taken for germination	Germination percentage	Number of days taken for 50% germination	Germination rate index (GRI)	Corrected germination rate index (CGRI)	Final survival percentage
Growing condition (G)						
G_1- Open condition	66.59	61.11	76.85	80.31	135.85	60.40
G_2- Green poly tunnel	62.59	67.07	71.15	93.20	140.63	67.07
S.Em ±	0.51	0.60	0.57	0.9	1.15	0.59
C.D. at 0.05	1.46	1.72	1.64	2.60	3.3	1.71
Seed treatment (S)						
S_1-Seed soaking in GA_3 @ 1000 mg/litre for 10 minutes	60.16	71.50	69.33	100.47	143.92	70.50
S_2-Seed soaking in GA_3 @ 1500 mg/litre for 10 minutes	60.00	75.16	67.67	108.96	146.27	73.83
S_3-Seed soaking in H_2SO_4 @ 50% for 30 minutes	69.50	51.17	81.00	62.49	122.27	50.33
S_4-Seed soaking in HNO_3 @ 50% for 30 minutes	66.83	55.33	78.17	73.43	133.09	55.33
S_5-Seed soaking in tap water for 7 days	64.16	64.83	72.66	87.51	139.58	64.83
S_6-Seed soaking in cow urine @ 20% for 24 hours	62.83	69.50	70.50	92.99	141.45	69.50
S_7-Mechanically scarification	57.17	85.00	64.67	126.28	159.50	85.00
S_8-Bio-NP @ 10ml/1litre water for 2 days	64.50	57.67	75.17	75.94	135.97	57.67
S_9-Control (without seed treatment)	76.17	46.67	86.83	52.77	122.07	46.67
S.Em ±	1.08	1.28	1.21	1.92	2.44	1.26
C.D. at 0.05	3.10	3.67	3.49	2.52	7.00	3.64
Interaction effect (G x S)						
S.Em ±	1.53	1.80	1.72	2.72	3.45	1.79
C.D. at 0.05	4.39	5.18	4.93	NS	NS	5.14
CV %	4.11	4.88	4.02	5.44	4.32	4.87

4. Conclusion

The result obtained from research experiment, it can be concluded that effect of green net poly tunnel and mechanically scarification recorded the significant effect on germination parameters. Minimum days taken for germination and days taken to 50% germination percentage and maximum germination percentage (%) and final survival percentage were observed by combine effect of green net poly tunnel with mechanically scarification.

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