J. Mountain Res. P-ISSN: 0974-3030, E-ISSN: 2582-5011 DOI: https://doi.org/10.51220/jmr.v20-i1.10
Vol. 21(1), (2025), 89-93

Influence of Light and Temperature on the Germinability and Growth Dynamics of Rheum Species: A Comparative Study of *R. Emodi* and *R. Moorcroftianum*

U.C. Maithani*

Department of Botany, Govt Degree college Narendranager Tehri, Uttarakhand

*Corresponding Author Email Id: ucmaithani612@gmail.com

Received: 14.04.2025; Revised: 21.05.2025; Accepted: 31.05.2025

Abstract: The present study investigates the germination behavior of two Rheum species—*Rheum emodi* and *Rheum moorcroftianum*—under varying environmental conditions. In *R. emodi*, the highest germination percentage (77%) was recorded under 20°C in light conditions, whereas the lowest (41%) was observed at room temperature in darkness. Conversely, *R. moorcroftianum* exhibited the highest germination rate (84%) under 20°C light conditions, while the lowest (73%) was noted in darkness. Maximum shoot length (4.0 cm after 15 days) was recorded in *R. moorcroftianum* under light conditions, whereas the shortest shoot length (3.25 cm after 15 days) was observed in both species under dark conditions. The mean root lengths for both species, R.*emodi* and *R. moorcroftianum,* after 15 days in dark conditions were 3cm whereas under light conditions the observed values were 3.55 cm and 2.75 cm respectively. These findings highlight the significant influence of light and temperature on germination and early growth performance in these species.

Keywords: *Rheum* species • Germinability • Effect of light

Introduction

Approximately ten species of the genus *Rheum* are reported from India, commonly referred to as Indian Rhubarb. These species are primarily distributed across the Garhwal Himalaya, Kashmir, Nepal, and Sikkim, at elevations ranging from 3000 to 4800 meters (Anonymous, 1972). In the Garhwal Himalayan region, two species are predominantly found: *Rheum emodi* (locally known as Archa) and *Rheum moorcroftianum* (locally known as Dolu). *R. emodi* is a robust herbaceous plant, typically ranging from 1.5 to 3.5 cm in height, and is distributed from Kashmir to Sikkim at altitudes of 3000 to 5200 meters. *R. moorcroftianum* is a herbaceous species inhabiting elevations between 3000 to 4800 meters in the Garhwal Himalaya.

Rhubarb is renowned for its medicinal value, primarily due to the rhizomes and roots of *Rheum* species. These plant parts are traditionally used in herbal medicine and also in dye production; powdered forms of *R. moorcroftianum* roots are utilized to dye woolens yellow (Anonymous, 1972). Despite their significance, *Rheum* species face threats from over exploitation and environmental disturbances. Biotic interference and anthropogenic pressures over the last few decades have led to habitat degradation and population decline, limiting natural regeneration. Consequently, conservation efforts are imperative for sustaining these medicinally important species. Immediate attention is required to ensure their multiplication and preservation in their natural habitats, especially within the temperate and alpine zones of the Himalayas.

Methodology

Plant Material

Two species of Rheum namely *R. emodi* (Archa) and *R. moorcroftianum* (Dolu) belonging to family Polygonaceae were selected for the study. Seeds of these species

were collected in october 2012, Just before the onset of germination winter, dried in open air for week and kept at room temperature

Seed Germination

Seeds of both the two species were germinated in petridishes (8 cm. diameter.) on one layer of what man no. I filter paper. Each petridishes containing 25 seeds on distilled water was used as germination medium. The petridishes were place at 20°c temperatures and room temperature condition in continuous light and dark condition.

Seedling Growth

The length of root and shoot of randomly selected seedlings was measured after when germination reach up to its climax in both the species of *Rheum.* The percentage of moisture content was calculated by the formula given by Evans (1972).

Results and Discussion

Seed Germination: The germination behavior of *Rheum emodi* and *Rheum moorcroftianum* under different temperature and light conditions revealed significant interspecific variation. The highest germination percentage was observed in *R. moorcroftianum* (84%) under 20°C with light exposure. This was followed by *R. emodi*, which exhibited a 77% germination rate under the same conditions. Conversely, the lowest germination percentage (41%) was recorded for *R. emodi* under room temperature in dark conditions (Tables 1-4)

Table 1. The percentage of Germination in *R.emodi* (Seed Germination 20°C)

Treatment /Replicate / Light	Date of Sowing	On set of Germination	Days after sowing										% of Germination
			5	6	7	8	9	10	11	12	13	14	
A	11-Oct 2022	16-Oct-22	0	0	2	9	12	14	15	15	16	16	64
B	11-Oct-2022	14-Oct-22	1	3	10	17	22	22	22	22	22	22	88
C	11-Oct-2022	14-Oct-22	2	3	12	18	18	19	20	20	20	20	80
D	11-Oct-2022	14-Oct-22	1	4	13	18	18	18	18	119	19	19	76
													Mean-77
Dark													
A	11-Oct-2022	16-Oct-22	1	4	10	10	14	14	15	15	15	15	60
B	11-Oct-2022	14-Oct-22	2	6	9	10	14	14	14	14	14	14	56
C	11-Oct-2022	15-Oct-22	0	2	10	10	12	12	12	12	12	12	48
D	11-Oct-2022	14-Oct-22	3	4	9	9	12	12	12	12	12	12	48
Mean-53													

Table 2. The percentage of Germination in R. moorcroftianum (Seed Germination20°C)

Treatment /Replicate / Light	Date of Sowing	On set of Germination	Days after sowing										% of Germination
			5	6	7	8	9	10	11	12	13	14	
A	11-Oct-22	16-Oct-22	0	0	1	5	5	9	10	12	12	12	48
B	11-Oct-22	16-Oct-22	0	0	3	3	4	8	11	11	13	13	52
C	11-Oct-22	17-Oct-22	0	0	0	1	2	3	3	4	4	4	16
D	11-Oct-22	15-Oct-22	0	1	2	5	9	14	14	17	18	18	72
													Mean-84

Dark													
A	11-Oct-22	16-Oct-22	0	0	1	6	11	16	18	21	21	21	84
B	11-Oct-22	16-Oct-22	0	0	1	7	9	16	16	17	17	17	68
C	11-Oct-22	17-Oct-22	0	0	0	0	2	4	14	15	16	16	64
D	11-Oct-22	15-Oct-22	0	1	1	6	7	14	14	19	19	19	76
Mean-73													

Table 3. The percentage of Germination in *R. emodi* (Room Temperature)

Treatment /Replicate Light	Date of Sowing	On the set of Germination	Days after sowing										% of Germination
			5	6	7	8	9	10	11	12	13	14	
A	11-Oct-22	14-Oct-22	4	11	13	15	16	16	16	16	16	16	64
B	11-Oct-22	14-Oct-22	3	10	11	14	14	14	14	15	15	15	60
C	11-Oct-22	14-Oct-22	2	9	14	15	18	18	18	18	18	18	72
D	11-Oct-22	14-Oct-22	2	7	13	16	17	18	18	20	20	20	80
													Mean-69
Dark													
A	11-Oct-22	15-Oct-22	_	2	4	8	9	9	9	10	10	10	40
B	11-Oct-22	14-Oct-22	_	2	7	12	12	12	12	12	12	12	48
C	11-Oct-22	14-Oct-22	1	6	9	12	12	12	12	13	13	13	52
D	11-Oct-22	14-Oct-22	_	_	_	1	5	5	5	6	6	6	24
													Mean=41

Seedling Development: Seedling development varied notably under the influence of light and temperature. The mean root length (3.55 cm after 15 days) was recorded in *R. emodi* under light conditions, while the same was recorded to be 3 cm under dark conditions. The mean root lengths for *R. moorcroftianum* after 15 days under light and dark conditions were recorded as 2.75 cm and 3 cm respectively. Evidently the root development was superior in light conditions for both the species. The mean shoot length (4.0 cm after 15 days) was observed in *R. moorcroftianum* under light conditions, whereas the mean shoot length under dark conditions was slightly lower (3.25cm). Shoot length growth rate for *R. emodi* was slower than that ovserved for *R. moorcroftianum* as after 15 days the observed mean shoot lengths under light and dark conditions were 3.42 cm and 3.25 cm respectively. In terms of moisture content, the highest percentage was observed in *R. moorcroftianum* seedlings (5.04%), while the lowest (4.56%) was recorded in *R. emodi* (Tables 5-7)

Table 4.The percentage of Germination in R.moorcroftianum (Room Temperature)

Treatment /Replicate Light	Date of Sowing	On the set of Germination	Days after sowing										% of Germination
			5	6	7	8	9	10	11	12	13	14	
A	11-Oct-22	14-Oct-22	2	7	15	17	17	17	18	18	18	18	72
B	11-Oct-22	14-Oct-22	0	3	11	16	18	18	19	19	19	19	76
C	11-Oct-22	14-Oct-22	1	9	13	15	18	18	18	22	22	22	88
D	11-Oct-22	14-Oct-22	2	8	15	16	16	18	18	20	20	20	80
													Mean-79
Dark													
A	11-Oct-22	15-Oct-22	0	3	9	13	17	17	17	17	17	17	68
B	11-Oct-22	14-Oct-22	1	4	6	10	10	14	15	18	18	18	72
C	11-Oct-22	14-Oct-22	1	11	13	17	20	20	20	20	20	20	80
D	11-Oct-22	14-Oct-22	1	12	14	16	18	19	19	21	21	21	84
													Mean=76

Seed germination is a fundamental prerequisite for the persistence and regeneration of plant populations, particularly for species of ecological and medicinal importance. This study aimed to elucidate the germination responses of two high-altitude *Rheum* species

— *R. emodi* and *R. moorcroftianum*— under varying environmental conditions.

The findings indicate slight interspecific differences in germination behavior. Notably, light and temperature were critical factors influencing germination rates and seedling growth. *R. moorcroftianum* responded more favorably to 20°C light conditions, which aligns with earlier reports suggesting that high-altitude species exhibit diverse germination requirements (Semwal et al., 1983; Nautiyal et al., 1988),Vinay Prakash,*et al*(2011), Ganga Datt*et al* (2017). Germination onset in both species was observed within four days of sowing, a trend consistent with observations made by Bliss (1985), Bonde (1965) and Bishnu Sharma Gaire*et al* (2024) in other alpine species.

Table 5. Growth Pattern of Rheum emodi (Light and Dark Condition)

Treatment/Replicate	After 10 days		After 15 Days	
	Root length	Shoot length	Root Length	Shoot length
Light				
A	3 c.m	2.3 c.m	35 c.m	3 c.m
B	2.2 c.m	2.2 c.m	3 c.m	3.5 c.m
C	4 c.m	2.5 c.m	4.5 c.m	3.5 c.m
D	2.8 c.m	3 c.m	3 c.m	4 c.m
Mean	3	2.5	3.55	3.42
Dark				
A	1 c.m	2.5 c.m	1.5 c.m	3 c.m
B	2 c.m	2.5 c.m	3 c.m	3 c.m
C	3.5 c.m	4 c.m	4 c.m	4 c.m
D	1.5 c.m	2 c.m	2.5 c.m	3 c.m
Mean	2	3	3	3.25

Table 6. Growth Pattern of *Rheum moorcroftianum* (Light and Dark Conditions)

Treatment/Replicate	After 10 days		After 15 Days	
	Root length	Shoot length	Root Length	Shoot length
Light				
A	1.8 c.m	2.5 c.m	2 c.m	2.5 c.m
B	2.5 c.m	2.2 c.m	4 c.m	4.3 c.m
C	1.2 c.m	3.5 c.m	2 c.m	4 c.m
D	3.5 c.m	4 c.m	4 c.m	4.2 c.m
Mean	2.25	3.5	2.75	4
Dark				
A	2.5 c.m	3.2 c.m	2.9 c.m	3.5 c.m
B	1.3c.m	2.5 c.m	3 c.m	3 c.m
C	3.5 c.m	4 c.m	4 c.m	4 c.m
D	1.5 c.m	2 c.m	2.5 c.m	3 c.m
Mean	2	3	3	3.25

Overall, the data suggest that light availability significantly enhances germination and seedling vigor in both species. These insights are particularly valuable for the conservation and propagation of *Rheum* species, which are under pressure from habitat disturbance and overexploitation. A comprehensive understanding of their germination ecology is essential for the formulation of effective conservation strategies.

Table 7. Percentage of moisture content both of the species of the *Rheum*

Species	**Replicate**	**Fresh weight**	**Dry weight**	**% Moisture content**

R. emodi	A	0.02	0.02	5.05
	B	0.02	0.02	4.21
	C	0.01	0.01	6.56
	D	0.01	0.01	2.30
	E	0.01	0.01	4.68
				Mean= 4.56
R. moorcroftianum	A	0.02	0.02	4.23
	B	0.02	0.01	4.58
	C	0.02	0.02	5.71
	D	0.01	0.01	6.06
	E	0.02	0.02	4.62
				Mean= 5.04

References

Anonymous (1972). The wealth of India. Chada Y. R. (ed) Press and information directorate, CSIR. New Delhi. II:3-6

Bishnu Sharma Gaire,Sharada Dhakal *et.al* (2024) Effect of elevated temperature and water stress on seed germination of the Himalayan medicinal herb *Aconitum spicatum. Journal of Ecology and Environment* (2024) 48:45.

Bliss (1985). Alpine in the physiological ecology of North America plants Communities in B. F. Chabot and H. A. Moony eds. Chapman and Hall. 41-65.

Bonde E K (1965). Studies on germination of seeds of Colorado plants. *Univ. Stud. Ser. Brol*. 14: 1-16.

Ganga Datt, Jai Singh Chauhan(2017). Influence of pre-sowing treatments on seed germinationof various accessions of Timroo *(Zanthoxylum armatum DC.)* in the Garhwal Himalaya. *Journal of Applied Research on Medicinal and Aromatic Plants* 7,DOI:10.1016/j.jarmap.2017.06.004.

Nautiyal S, and Purohit A N (1983). Seed germination in some Himalayan Alpine and subalpine Composites, seed res., 13: 1-7- 3.

Nautiyal S, Nautiyal M C,.Rawat A.S and Bhadola, S K (1988). Germination in two *Aconitum* species, *Seed Research*, 14: 133-139.

Semwal J K, Purohit A N, and Gaur R D. (1983). Seed germination in Himalaya alpine plants. *Seed Research*, 11: 42-46.

Vinay Prakash, Bisht H and M.C.Nautiyal,(2011). Seed Germination Enhancement in High Altitude Medicinal Plants of Garhwal Himalaya by Some Pre-sowing Treatments. *Research Journal of Seed Science* 4(4):199-205DOI:10.3923/rjss.2011.199.205.