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EFFECT OF DIFFERENT LIGHTS ON THE SEED GERMINATION OF HIPPOPHAE SALICIFOLIA

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ABSTRACT

Hippophae salicifolia D.Don (Vernacular – Chuk. Tarwa) is a deciduous tree species restricted to the Himalayan region, between 1500-3500 m a.m.s.l. Seeds of H. salicifolia were collected in the month of October 2009 from Uttarakhand State and exposed to different lights. Experiments were conducted in order to investigate germination behavior of H. salicifolia seeds subjected to different lights (red, blue, green, yellow and white as control). The experiments were conducted with four replications in each treatment and twenty five seeds per replication. The results of the study revealed that maximum germination percentage was found under red and yellow lights. Maximum radicle and plumule length was observed in white light (control) but minimum under green light. The study establishes the colour dependence of germination of the seeds of this species.

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KEY WORDS

Hippophae salicifolia, Himalayan, deciduous, germination percentage, light

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[I] INTRODUCTION

Hippophae salicifolia is a deciduous tree restricted to the Himalayan region, between 1500-3500 m a.m.s.l. found in dry temperate forests of western Himalayas in north east aspects, sloppy areas near river banks, sandy soil, and towards sun facing directions.

The seed germination is the prominent reason for regeneration of species in natural habitats. Ecologically, the best germination and growth of species are achieved, where environmental factors are balanced. Light is one of the environmental factors that affect the germination and growth of the plants. Light is important for seed germination and growth. Many species respond to the environment with optimal growth and development according to the light they receive [1]. Some seeds germinate similarly in light and darkness [2], while others do it more readily either under light [3] or dark conditions [4]. Also, light requirements for germination can vary with temperature. It has been demonstrated that some species need a constant temperature and light to germinate and others can germinate either under light or dark conditions but need temperature fluctuations [5]. In other species, stratification [6] or high temperatures [7] replace light requirements for germination

[II] MATERIALS AND METHODS

In the present study, an experiment was designed to assess the effect of different types of light: white (fluorescent) as control, red light with wavelength 630 - 740 nm, green light with wavelength 520 - 570 nm, blue light with wavelength of 450 - 495 nm and yellow light with wavelength of 570 - 580 nm (all electric lights from Philips, India) on seed germination of *H. salicifolia* and also on its radicle and plumule growth.

The investigation was carried out in three Provenances of Uttarakhand State in India viz. Uttarkashi (P1), Chamoli (P2) and Pithoragarh (P3). The geographic range of the provenances selected varied from 30° 03´ to 31° 34´ N latitude, 74° 30´ to 80° 13´ E longitude and 1949 to 3212 m altitude. A minimum of ten trees were randomly selected for collection of seeds from each provenance.

Seed for each replication were placed on top of Whatman no.1 paper in petri plates in the seed germinator at 25 ± 1º C. Each Petri plate was marked with date of experiment and replication number. There were 5 treatments in this experiment including the control (white light). The experiment was undertaken in completely randomized design (CRD) with four replication in each treatment and twenty five seeds per replication.

Data on different germination parameters were recorded after germination at 2-day intervals until no further germination occurred. The seeds were inspected every day and were considered to be germinated when the radicle penetrated the seed coat and attained about 1mm in length [8]. Radicle and plumule length (cm), were measured on the 25th day.

Response Index (RI) was calculated as per the formula given by Richardson and Williamson [9] for the magnitude of inhibition versus stimulation by different lights on seed germination and radicle / plumule

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growth of *H. salicifolia*.

Response Index is calculated as

RI = (T/C -1) × 100
Where,

T = Parameter under Treatment
C = Parameter under Control

[III] RESULTS AND DISCUSSION

The present study revealed that the maximum germination percentage was observed in P2 under red light (89%) followed by yellow light (85%) in P1 and minimum germination observed in green light (50%) in P2. The maximum negative influence was observed in green light (-37.5) followed by blue light (-31.25) in P2. However minimum negative influence was observed in red light (-1.19) followed by yellow light (-4.76) in P3. P3 showed negative influence on seed germination in all the lights under study **[Table -1]**

Table: 1. Effect of different lights on seed germination of *Hippophae salicifolia*

Treatments	Seed germination (%)					
	P_1 (%)	RI	P_2 (%)	RI	P_3 (%)	RI
White	73	-	80	-	84	-
Red	85	16.44	89	11.25	83	-1.19
Blue	64	-12.33	55	-31.25	65	-22.62
Yellow	76	4.11	85	6.25	80	-4.76
Green	58	-20.55	50	-37.5	54	-35.71

Comparing RI = Response Index

The effects of lights on radicle growth showed that maximum radicle length was observed under white (2.08 cm) in P1 and minimum under green light (1.10 cm) in P3. Red ,blue, yellow and green light have negative effect on radicle growth in P1, while in P2 red and green light have negative influence but blue and yellow light have positive influence. In P3 blue and green light have negative influence but red and yellow light have positive influence on radicle growth of *H. salicifolia* **[Table -2]**.

Table: 2. Radicle growth (cm) and Response index (%) of *Hippophae salicifolia* under different lights

Treatment	Radicle growth (cm)					
	P_1	RI	P_2	RI	P_3	RI
White	2.08	-	1.53	-	1.58	-
Red	1.90	-8.65	1.48	-3.27	1.63	3.16
Blue	1.64	-21.15	1.62	5.88	1.28	-18.99
Yellow	2.02	-2.88	1.60	4.57	1.82	15.19
Green	1.15	-44.71	1.20	-2.17	1.10	-30.32

RI = Response Index

The effects of lights on Plumule growth showed that maximum plumule length was observed in yellow (3.34 cm) and minimum under green light (1.13 cm) in P1. Red, blue and green light have negative effect on plumule growth in P1, while yellow light has positive influence. The results of P2 reveal that red, blue, yellow and green light have positive influence on the growth of plumule. P3 revealed positive influence of red, blue and yellow light on Plumule growth of *H. salicifolia* **[Table -3]**.

The results of the study reveal that except in P3, red and yellow light increase the germination percentage **[Table-1]**. However, green light decreases the germination as well as radicle and plumule growth during the study period **[Tables- 2 and -3]**. It is known from earlier works that light is an important factor affecting germination and seedling growth. Research works from Ellis and Robert [10], Hangarter [11], Wapeha and Kaufman [12] and Winslow [13] showed that many plant species responded to the environment with optimal growth and development according to the light they received and Colbach *et al*., [3] reported that some seeds germinated under different lights. In this experiment, the maximum germinations are observed under red light and yellow light irrespective of the provenance. Germinations of seeds of *Ruellia tuberose* [14], *Asteracantha longifolia* [15] and *Cucumis callosus* [16] are also reported to be promoted when

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irradiated with red light. These reports somewhat supported the findings of David and Chawan [15] and Shyam and David [17] that the red region of spectrum (590 and 680µm) was most effective for the germination of light requiring seeds.

Table: 3. Plumule growth (cm) and Response index (%) of Hippophae salicifolia under different lights

Treatment	Plumule growth (cm)					
	P_1	RI	P_2	RI	P_3	RI
White	3.08	-	1.93	-	1.90	-
Red	2.60	-15.58	2.04	5.69	2.00	5.26
Blue	2.46	-20.13	2.16	11.91	2.06	8.42
Yellow	3.34	8.44	2.74	41.96	2.50	31.57
Green	1.13	-63.31	1.10	-43.02	1.22	-35.72

RI = Response Index

H. salicifolia seeds germination started 5-8 days after sowing in red and yellow light and seeds under blue light started to germinate after 12 -15 days. David and Chawan [15] and Shyam and David [17] also reported that the seedling growth of some *Merremia* species was the least in blue light. This was similar to the findings of Wareing and Black [18] and Gwynn and Scheibe [19] with regard to lettuce seeds. *H. salicifolia* seeds under red and yellow light showed the fastest germination. Shyam and David [17] reported that the highest percentage of some *Merremia* sp. was found in red light.

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