

STUDIES ON SEED GERMINATION OF *PODOPHYLLUM EMODI* WALL

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Abstract

Seed of *Podophyllum emodi* showed enhanced germination between 18 to 21°C after exposure to 900 Lux of light for 12 to 24 hours. Pre-soaking of seed in water up to 120 hours and 48 hours with and without aeration did not affect germination, although its pre-soaking up to 120 hours without aeration reduced its germination.

During large scale cultivation of *Podophyllum emodi* Wall., in North West Pakistan (Rowe, 1966), seeds of this medicinal plant from different ecological regions showed variable germination. Very often the seed obtained from certain regions, failed to germinate. Troup (cit. Bahdwar & Sharma, 1963) found that the seeds of *P. emodi* lay dormant in the soil after sowing for about 2 to 3 years but when sown in August, at an altitude of 660 m they germinated between 3 to 7 months after sowing. It was concluded that germination in this seed was forced under abnormal conditions of temperature. Bahdwar & Sharma (1963), however, recorded 44% germination within a period of 9 to 10 months in the seed sown at 2100 m with fruit pulp immediately after collection. Factors affecting delayed and variable germination in the seed may be inherited or may be due to differences in environmental conditions under which the seed matured or was sown for germination. No information is available on the factors controlling germination of the seed of *P. emodi*. Present paper includes a study of some factors under laboratory conditions which influence germination.

Materials and Methods

Seeds were obtained from Doongagali Seed Farm (Established by Sandoz (Pak) Ltd. in 1963) at an elevation of about 2600 m. The seeds were immediately depulped from the freshly harvested fruits, thoroughly washed in water, dried and stored in cloth-bag under laboratory conditions at 10 to 20°C for the first 5 months, thereafter at 20 to 25°C. Germination of the seeds was studied between 5 and 14 months after harvest. No selection of seed was carried out and these contained all sizes. Seeds which floated on water during washing were discarded.

Preliminary studies showed that of the total imbibing capacity, at least 70 percent water was taken up by the seed at 20°C within the first 24 hours. Thus before the beginning of any treatment, seeds were presoaked in deionized water and 100 seeds were then placed at uniform distance on moist filter papers in a 9 cm dia Petridish. There were three replications in each treatment.

In order to study the effect of temperature on germination, the dishes were incubated at 10°, 15°, 18°, 21°, 24°, and 30°C. without the provision of light. To

study the effect of light on germination, the light was obtained from a reflector fitted with three 50 watts mercury lamps and six neon tubes each 1 m long. Each set of Petridishes, containing seed presoaked in complete darkness was placed at varying distances from the source of light, so that one set each was exposed for 48 hours to 450, 900, 1800 and 3600 lux of light. After exposure to light the seeds were incubated in the dark until the termination of the experiment. The duration of light, necessary for the maximum germination of seed was determined by placing the seed presoaked in water in complete darkness under constant light (900 lux) for 6, 12, 24, 48 and 96 hours.

To study the effect of aeration and prolonged soaking upon the germination capacity of seed, the seeds were aerated or soaked for 24, 30, 36, 48, 96 and 120 hours in water at 20°C under light (approx. 900 lux). Aeration was carried out by bubbling the air through water containing seed. Soaking of seed without aeration was done without any change of water throughout the period of soaking.

The seeds in all the experiments after the respective treatment were incubated in dark at 20°C, unless otherwise stated. A seed was considered germinated when its radicle after growth, emerged through the seed and was clearly visible. When necessary sufficient water was added to the Petridishes to moisten the filter papers. In the experiments on light, intensity the data was obtained in dim light.

Results

Effect of Temperature: The rate of germination of the seed of *P. emodi* was highest at 18°C (Table 1). Above and below this temperature the rate of germination declined. Germination was however, significantly less at 15°C and 24°C than that at 18°C ($P=0.05$). The seed incubated at 10° and 30°C did not show any germination at all during the period of experimentation.

TABLE 1. Effect of temperature on the germination of the seed of *P. emodi*.

Temperature (°C)	D A Y S		
	15	25	35
	Percentage germination		
10	0	0	0
15	0	18.0	48.0
18	3.7	44.0	63.0
21	3.7	37.3	59.7
24	0	13.0	32.0
30	0	0	0

S.E. = 4.2

TABLE 2. Germination of the seed of *P. emodi* after its exposure to different intensities of light

Light (lux)		Days		
		Percentage germination		
0	0	7.7	24.0	62.3
450	1.0	19.7	40.7	65.0
900	2.0	30.0	45.3	64.3
1800	1.0	21.0	45.0	70.0
3600	0.7	20.0	37.7	69.7

S.E.=5.8

Effect of Light: At 26 and 35 days the seeds exposed to different intensities of light showed significantly higher rate of germination ($P=0.05$) than the seed kept in dark (Table 2). However, with the prolonged incubation up to 62 days there was no significant difference in the total germination between the seed exposed to light or kept in dark. Exposure of seed to 900 lux of light for 12 to 24 hours significantly increased germination up to 25 days although in this case also, the total germination was not significantly different between these treatments 34 days after the beginning of the experiment (Table 3).

TABLE 3. Germination of the seed of *P. emodi* after exposure to light (900 lux) for different intervals of time.

Exposure to light (Hours)		Days		
		Percentage germination		
0	0.0	22.0	45.3	
6	3.3	26.3	45.0	
12	4.8	32.0	50.0	
24	5.3	30.7	49.7	
48	3.0	25.7	50.3	
96	4.0	28.7	47.7	

S.E.=4.1

Effect of aeration: As shown in Table 4 total germination of seed incubated up to 35 days after soaking in water with or without aeration for 24, 30, 36 and 48 hours was not significantly different between the treatments. However, total germination for the same period in the seed soaked without aeration up to 120 hours was significantly less than the seed soaked in water with aeration ($P=0.05$).

TABLE 4. Germination of the seed of *P. emodi* incubated for 35 days after soaking in water, with or without aeration for different intervals of time.

Treatment		Time (hours)			
		Percentage germination			
Soaking with aeration	66.0	59.3	68.7	65.7	66.7
Soaking without aeration	65.7	64.0	64.0	63.0	55.3
S.E. = 3.2					

Discussion

Although the seeds of many economic plants have a wide range of temperature for their maximum germination (Mayer & Poljakoff-Mayber, 1963), the present studies show that the seed of *P. emodi* has a relatively narrow temperature range for its maximum germination. Thus it is likely that delayed germination of this seed in soil at 660 m (Troup, loc. cit.) or at 2100 m (Bahdwar & Sharma, 1963) may be due to great fluctuations of temperature normally affecting the seed when sown in soil. It is likely that the seed sown in soil may further be affected by the depth of sowing, since requirements for the maximum germination of this seed appears to be within a narrow range of light too.

Bahdwar & Sharma (1963) obtained 44 percent germination and recommended the sowing of *Podophyllum* seed along with fruit pulp immediately after collection. They found no germination in seed sown after thorough washing and soaking them in cold water for 24 hours. Present studies however, show that thorough washing of seed and prolonged soaking with aeration did not inhibit germination whereas soaking up to 120 hours without aeration retarded germination. This is in agreement with the studies of Troup (Loc. cit), who also found deleterious effect on germination in this seed soaked for 8 days.

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