

## Seed Germination Studies on *Parthenium hysterophorus* Linn.

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The seeds of *Parthenium hysterophorus* Linn. were found germinating in a wide range of pH from 2.5 to 10. Seed germination was minimum at pH 2.5 (10%) which increased to 100% between pH 5.5 to 7.1. The percentage of germination was less (54%) at pH 10 and the germination was inhibited at pH 11. Exposure to 90°C for 24 hr prior to germination brought down the percentage germination to 8 and pretreatment at 0°C for 24 hr raised it to 26. Treatment at 40°C caused 100% germination. The seed germination was inhibited under continuous red, blue, green and white light but not under yellow light. This inhibition was overcome when the seeds were transferred to darkness (in a BOD incubator) at 20°C. The experiments showed the reasons for wide ecological amplitude and high adaptability of *Parthenium* under varied ecological conditions.

**Key Words:** *Parthenium hysterophorus*, Ecological amplitude, Notorious weed, Achene, BOD incubator, Replicate

### Introduction

*Parthenium hysterophorus* Linn., a notorious weed, is spreading rapidly in various cultivated and non-cultivated fields of Ujjain, by eliminating various plant species in its association (Dagar et al. 1976, Mall & Dagar 1979). The effects of various chemical substances and growth regulators on seed germination of this weed have been studied by Dagar et al. (1977). Various effects of light, temperature and pH on the physiological processes involved in seed germination

of some plants have been studied for many years (Toole et al. 1956). Responses of these factors on seed germination of various species have been noted by many workers (Nicolic 1924, Stephan 1928, Bohmer 1928, Rollin 1958, Black & Wareing 1960, Datta & Biswas 1969, Evenari 1965, Kadmanzahavi 1957 & 1960, Koller et al. 1962, Singh & Mall 1977, Singh et al. 1975 and others). *Parthenium hysterophorus* has spread to many parts of the country in the last two decades showing a wide ecological amplitude. The present study was therefore taken

up to ascertain the impacts of temperature, pH and light on seed germination.

### Material and Methods

Fresh seeds (botanically fruits called achenes) were collected in the month of May, 1978 from banks of river Kshipra near Ujjain. The pH of the solutions used ranged from 0.8 to 11.0; these were prepared by adding HCl and NaOH to distilled water. The seeds were germinated in sterilized petri dishes containing double filter paper pads. The petri dishes were kept in a BOD incubator at 20°C. The filter paper pads were moistened by adding 5 ml of each solution. For experiments in which pre-germination exposure to temperature for 24 hr was to be given, the seeds were kept in the freezing compartment of a refrigerator or in an incubator at 15, 40, 50, 60, 70, 80, 90 and 100°C. For the study of the effects of different qualities of light, four glass chambers were taken which were covered with cellophane papers of red, blue, yellow and green colours. In-

condescent light of 280 lux was used for experiments. Fifty seeds were taken in each petri dish and three replicates of each set were made. The observations were noted till there was no seed germination for further three days.

### Results

*Effect of pH* (table 1): Ten percent of the seeds germinated at pH 2.5 and below that none of the seeds germinated. Above pH 2.5 there was increase in the percentage of seed germination and it was maximum at pH 5.5 and 7.1 (100%). After that it again started declining. Seeds failed to germinate at pH 11.

*Effect of temperature pre-treatment on seed germination* (table 2): Seeds of *Parthenium hysterophorus* can germinate even after treatment at 0°C for 24 hr. Germination was maximum (100%) when seeds were pre-treated at 40°C for 24 hr. After that it started declining. Seeds failed to germinate at 100°C.

Table 1 *Effect of pH on seed germination*

pH	0.8	1.5	2.5	3.5	4.5	5.5	6.5	7.1	8.2	9.5	10.0	11.0
Seed germination %	0	0	10	42	44	100	96	100	84	70	54	0
No. of days for maximum germination	—	—	6	5	6	5	5	5	5	5	5	—

Table 2 *Effect of temperature pre-treatment on seed germination*

Pre-temp. treatment for 24 hr (°C)	0	15	40	50	60	70	80	90	100
Seed germination %	26	62	100	70	66	24	12	8	0
No. of days for germination	5	5	4	4	5	5	6	6	—

Effect of different qualities of light (table 3): Red, blue, green and continuous light caused complete inhibition of seed germination until 6 days except yellow light (4% germination). When the seeds exposed to different qualities of light were transferred to the BOD incubator at 20°C in complete darkness, however, a good percentage of germination was observed in all the cases.

**Table 3** Effect of different qualities of light on seed germination (Percentage calculated after treatment with light for 6 days and then placing in BOD incubator)

Light quality	Seed germination %	Days required for maximum germination
Red	88	3
Blue	78	4
Yellow	90	2
Green	88	3
Control (White)	100	3

Intensity of light was: Red=80 lux, Blue=75 lux, Yellow=100 lux, Green=110 lux and White light=280 lux.

## Discussion

Seeds of *Parthenium* showed better germination in the acidic range rather than in the alkaline—maximum at pH 5.5 and 7.1. Even at pH 2.5 some seeds germinated showing high acid tolerance. Singh et al. (1975) also observed a similar type of response in the seeds of *Iseilema*. These results support the view of Salter and McIlvaine (1920), that slight acid reaction is favourable for seed germination. Contrarily Singh et al. (1975) showed a better germination response in

*Apluda aristata* at pH 8.0 to 9.5. This demonstrates genetic variability of seeds to soil pH conditions.

Exposure for 24 hr to 0°C inhibited seed germination. Dutta and Biswas (1969), and Singh and Mall (1977) also showed inhibition of seed germination in *Pistia stratiotis* and *Fagopyrum esculentum* respectively under subfreezing temperature. Kawahava and Takada (1961), however, reported favourable germination in *Trapella*. Singh and Mall (1977) further showed that the seeds which failed to germinate in subfreezing chamber, germinated when exposed to light. Thus, light has a very important role in the germination of seeds. *Parthenium* shows a wide range of temperature tolerance. Seeds treated at 90°C also showed germination though it was only 8%. The precise mechanism by which temperature affects germination remains unknown (Koller et al. 1962).

There are various reports of biological activity of blue light on seed germination (Evenari 1965, Neumann & Stein 1957, Black & Wareing 1962). Stephan (1928), Meischke (1936), Resuhr (1939) and Rollin (1958) reported suppression of seed germination in red, yellow, green and blue light. In the present investigation also these qualities of lights showed complete inhibition of seed germination (except yellow light). However, after six days of continuous illumination to these lights, when the seeds were transferred to complete darkness at 20°C, seeds germinated, showing that inhibition could be reversed.

These results indicate that *Parthenium* seeds have a good capacity to germinate under wide ranges of pH and temperature. This is one of the important reasons for its wide ecological amplitude. Acidity and alkalinity of a wide range do not seem to pose any problem for seed germination in this

plant, which is highly adapted to varied ecological habitats.

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