

EFFECT OF TEMPERATURE ON RADICLE AND PLUMULE ELONGATION IN *VIGNA SPECIES*.

By Subodh Narayan

Dept. of Botany, A.N. College, Patna

nrsubodh@gmail.com

ABSTRACT

Germination is a vital phenomenon and determines the behaviour pattern of plant in terms of growth, morphogenesis, flowering and seed setting. All these activities from germination to seedling establishment and frutification to yield potential product depend on these phenomena. Several physical parameters such as Temperature, Moisture, Photoperiod, Water condition and Mineral uptake are closely coordinated by the system to sequence the developmental process of the biological clock. Temperature is an important parameter which affects the germination of seeds in any agro-climatic zone. This research work was carried out to know the effect of Temperature and Light on germination.

RESULT

Temperature plays a vital role in the growth and morphogenesis of plant. Growth and development of *V. mungo* (L) and *V. radiata* (L) with respect to germination has been studied under different range of temperature and it has been observed that the rate of physiological activities were significantly influenced by varying range of germination temperatures of plant varies greatly on different range of temperatures.

KEY WORDS

Germination, Temperature, Radical, Plumule emergence, Survival.

INTRODUCTION :

Suitable environmental conditions are essential for successful germination and establishment of plants in any agro-climatic regions. In nature, the failure of seed to germinate and seedling to establish is governed by factors such as temperature, moisture content, availability of light, irrigation and storage. Germination behavior of *Vigna mungo* L and *Vigna radiata* L were studied at different ranges of temperature (16⁰C-45⁰C) at an interval of 5⁰C. Many workers reported that at 40⁰C the germination potentiality of seeds got affected due to partial denaturation of protein and enzymes (Pandey) 1987; Singh, R.S., 1989) Similar result was observed in this research work showing injurious and deleterious effects of temperature at 45⁰C. The lower ambient temperature also suppresses the rate of germination. Adaptability in the germination response of species to environmental fluctuation constitutes an important aspect in growth and morphogenesis of both the species.

MATERIALS AND METHODS :

Seeds of *V. mungo* L and *V. radiata* L wilczek were collected Scores of germination were made after germinating hundred seeds of each species in petri-dishes on pre-moist Whatmann filter paper backed with sterilized cotton wool. Five replicates of each species having hundred seeds were germinated for control and different treatments simultaneously. The germination was recorded at regular intervals of 24 hours for all experiment. Seeds with 1 mm radical were taken as germinated. That data were recorded after 24 and 72 hours. Five treatments of 16-20, 21-25, 26-30, 31-35, 36-40 and 41-45 were taken with three replications.

The effect of temperature on germination was studied in B.O.D. incubator (Model No. CI √ - 01). The experiments were conduct at different range was from 15⁰C to 45⁰C with an interval at of 5⁰C. The optimum temperature 30⁰C 2⁰C was taken as control.

RESULT AND DISCUSSION :

Experiments were conducted for two consecutive years to know the effects of temperature on germination and emergence of radical and plumule. The data have been presented in Table 1 and 2. It was observed that the two varieties of *Vigna* under reference responded at different temperatures in more or less similar way. The response of *V. mungo* was slightly better than *V radiata* with the temperature range between 25⁰C to 35⁰C, while the response of *V. radiata* was slightly better L at 15⁰C to 40⁰C indicating that *V. radiata* L Wilzeck is more temperature tolerant than *V. mungo* L.

Table -1 : Effect of temperature on germination percentage of Vigna Spp.

Species Temp. ⁰ C	Vigna mungo	Vigna radiata
15	20	30
20	48	78
25	100	94
30	100	98
35	82	97
40	45	50
45	NIL	NIL

The result indicated that 100% germination was obtained at 25⁰C to 30⁰C, in *V. mungo* where in *V. radiata* it was 94% and 98% respectively at the same temperature (Table 1). In both the cases, the seeds failed to germinate at 10⁰C and 45⁰C showing inhibitory effect of low and

high temperatures. The inhibitory effect of temperature has been also recorded by many works. (Pandey, 1987 and Singh, 1982)

Complete inhibition of germination may be due to the enzyme effect or due to partial denaturation of protein. In *V. mungo* the percentage germination after 24 hour was only 20% while in *V. radiata* it was only 30%. At 20°C, the germination percentage in *V. mungo* was 48% whereas in *V. radiata* it was 78%. This clearly indicates that effect of temperature was a determining factor for germination and survival of plants. The deleterious effect of temperature was also recorded at 40°C. The germination at 20°C temperature. It was observed that the survival percentage of seedling was reduced after exposing the seedling at 35°C and 40°C indicating the harmful effect of high temperature. Result data at 40°C, showed that the drastic reduction in germination percentage was found and also clearly marked in between 35°C and 40°C. Similar results were also recorded in between 15°C to 30°C. However, the reduction rate of germination was at par in between 30°C to 35°C, and 25°C to 20°C indicating that *V. radiata* L is more resistant than *V. mungo* L.

The effect of various temperatures ranging between 15°C to 25°C at an interval of 5°C on radicle and plumule emergence in *V. mungo* and *V. radiata* were recorded and tabulated in Table 2.

Effect of different temperature on Radicle and Plumule emergence in *V. Mungo* L Hepper and *V. radiata* L Wilczek.

Species :- Temp.	<i>V. mungo</i>						<i>V. radiata</i>					
	24 hrs.		48 hrs.		72 hrs.		24 hrs.		48 hrs.		72 hrs.	
	R	P	R	P	R	P	R	P	R	P	R	P
15°C	Nil	-	-	-	-	-	-	-	-	-	-	-
20°C	0.32	0.00	2.09	0.62	2.47	2.05	0.93	0.00	2.49	1.75	3.46	2.38
25°C	1.74	0.92	3.66	2.90	5.07	4.46	2.23	2.70	4.00	6.34	5.80	9.79
30°C	1.95	1.50	4.10	4.31	5.75	6.93	2.46	3.10	4.21	6.93	7.50	9.31
35°C	2.08	3.02	4.48	4.99	6.16	8.55	3.64	3.52	5.43	7.22	5.64	8.56
40°C	0.99	0.44	1.52	0.73	1.72	0.96	1.50	1.70	2.43	3.04	3.30	4.58
45°C	Nil	-	-	-	-	-	-	-	-	-	-	-

R = Radicle, P = Plumule

It was observed that the plumule emergence was high at 45°C showing inhibitory effect of temperature in both the species under reference. Such type of observation was also reported by many workers. (Leite 1916, Dwyer and Sedley 1972, Buhrose and wold 1978, Pandey 1979, Mehanna et. al. 1985, Hasanah 1988, Benden 1991, Baburatan 1993, Hegarty 1997 and George and Barma 1997.

The data were recorded after 24, 48 and 72 hours and radicle plumule ratio was calculated after each observation. In *V. mungo*, it was observed that the plumule emergence did not take place at 15°C and 20°C after 24 hour, whereas after 48 and 72 hours the plumule

emergence was recorded at 20⁰C while there was no growth at 15⁰C. This may be due to the low temperature effect. When P/R ratio is compared with high and low temperature, a clear reduction was recorded showing the adverse effects of temperature on germination. It was also observed that at higher and lower temperature have inhibitory effect on radicle and plumule emergence in both the species.

In *V. mungo*, the maximum plumule/radicle emergence was recorded as 2.08 mm (radicle) and 3.02 mm (plumule) respectively and the P/R ratio was 1.45. At 30⁰C, the radicle was recorded as 1.95 mm and plumule was 1.50 mm with P/R ratio 0.7 after 24 hours. At higher temperature i.e. 40⁰C, the rate of radicle/plumule emergence was reduced showing adverse effects of higher temperature. This type of observation was recorded by many earlier workers. There was no growth recorded at 45⁰C. The lower temperature 0⁰C and 15⁰C) was also not suitable for seed germination, as plumule emergence was not recorded after 24 hours. However, plumule emerged after 48 and 72 hours recorded at 20⁰C but the rate of elongation was very slow. When emergence rate was compared with the survival rate, it was observed that suitable temperature for growth of *V. mungo* has been between 25⁰C to 30⁰C.

In *V. radiata*, the radicle/plumule emergence and P/R ratio was calculated and it was observed that best temperature for radicle and plumule elongation was 25⁰C and 35⁰C. After 72 hours, it was found that plumule length was 9.39 mm at 25⁰C and 9.7 mm at 30⁰C. The radicle elongation was 5.8 mm and 7.5 respectively on both the temperature. The highest P/R value 1.68 was recorded at 25⁰C followed by 1.5 at 35⁰C

CONCLUSION:

Temperature plays a vital role in the growth and morphogenesis of plant. Growth and development of *V. mungo* (L) and *V. radiata* (L) with respect to germination has been studied under different range of temperature and it has been observed that the rate of physiological activities were significantly influenced by varying range of germination temperatures of plant varies greatly on different range of temperatures. The yield component and the productivity are directly linked with germination of plant. The effect of temperature on germination and emergence of radicle / plumule has been quite significant in *V. mungo* (L) and *V. radiata* (L). Therefore, it can be concluded that the lower and higher temperatures are not suitable for growth and development for *Vigna* species.

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