

Effect of Gamma-radiations on Germination and Seedling Growth of Certain Arid

Zone Trees

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Stimulation in germination percentage was observed when seeds of *Hevea brasiliensis* Muell. -Arg. were irradiated with gamma rays by Saraswathy *et al.* (1983). However, no such efforts have been made so far for arid zone trees. Hence a preliminary study was undertaken to explore for any beneficial mutagenic effect of gamma radiations on germination and early seedling characteristics of three arid zone tree species.

Air dry seeds of *Acacia senegal* (L.) Willd. (10% moisture), *Acacia tortilis* (Forskall) Hayne (5% moisture) (both chemically scarified by keeping in concentrated H₂SO₄ for 20 minutes at 31°C) and *Hardwickia binata* Roxb. (10% moisture) were exposed to 100, 200, 400 and 800 Gray doses of gamma rays at a dose rate of 77.5 Gray minute⁻¹ at Bhabha Atomic Research Centre, Bombay, India. Irradiated seeds were sown in the month of March on moist filter paper in petridishes at room temperature (31°C) in randomised complete block design with five replications. Each replication contained 10 seeds. Data on seed germination, cotyledon length, cotyledon breadth, radicle length, hypocotyl length and fresh seedling weight were recorded after 10 days of sowing.

The results (Table 1) show that except the cotyledon breadth (in *A. senegal*), hypocotyl length (in *A. tortilis* and *H. binata*), radicle length (in *H. binata*) and radicle + hypocotyl length (in all three sp.) all parameters were unaffected by gamma irradiation of the seeds. However, significant stimulatory responses over the control observed in cotyledon breadth in *A. senegal* and in hypocotyl length in *A. tortilis* and significant diminutive responses observed in radicle + hypocotyl length in *A. senegal* and *A. tortilis* at higher doses only (at 400 and 800 Gray or at 800 Gray only) point towards the characteristic hard seededness of desert legume trees (Krugman *et al.* 1984). Khamankar and Singh (1988) also reported in case of another

legume tree *Leucaena leucocephala* that low gamma-ray dose (200 Gray) was ineffective in bringing about any variability in germination percentage whereas high dose (870 Gray) brought about 50% reduction in the above said parameter. According to them, the hard seedcoat nature of *Leucaena* seeds can be the possible reason for its reported radio-resistance along with the other factors. Only high doses of radiation must be penetrating the hard seed coat of such physically dormant seeds to bring about significant variations in seed and seedling characteristics. On the contrary, Sharma (1990) reported that very low gamma-ray doses (50 Gray) produced stimulatory responses in plant height, number of leaves per plant and stem diameter following irradiation of soft seed coated *Grewia optiva* (Biul). Higher doses gave lower values for different parameters studied.

Hardwickia binata is a non-legume with seeds having soft seed coats. Its seeds do not require any pretreatment for germination as in case of *A. senegal* and *A. tortilis*. Therefore, highly significant variation from the control (diminutive effect) in radicle length was observed even at the lowest dose (100 Gray) tried (Table 1). Other doses were at par with 100 Gray in reducing radicle length as compared to control. Radicle length seems to be the most sensitive character in *H. binata* as opposed to in case at *A. tortilis* and *A. senegal*, where it was unaffected by irradiation at any of the four doses tried.

It is clear from the above results that most of the parameters studied at early seedling stage in three arid zone tree species in question were unaffected by the gamma ray doses used for irradiating the seeds. Probably higher doses are required to produce significant variations in the unaffected parameters.

Table 1 Effect of gamma radiation on germination and seedling characteristics of arid zone tree species.

Gamma-ray dose (Gray)	Characters studied						
	Per cent germination	Cotyledon length (cm)	Cotyledon breadth (cm)	Radicle length (cm)	Hypocotyl length (cm)	Radicle + hypocotyl (cm)	Fresh seedling weight (mg)
<i>A. Senegal</i>							
Control	38	1.39	1.18	2.38	1.99	4.38	278.0
100	68	1.34	1.27	2.05	2.36	4.40	350.4
200	54	1.31	1.29	1.93	2.28	4.22	346.2
400	64	1.32	1.36	1.71	2.22	4.05	350.8
800	70	1.31	1.30	1.68	2.09	3.72	308.2
CD 5%	—	—	0.11	—	—	0.19	—
CD 1%	—	—	—	—	—	0.26	—
<i>A. tortilis</i>							
Control	86	0.97	0.75	5.70	2.61	8.44	150.4
100	92	0.93	0.74	6.92	2.78	9.70	140.0
200	90	0.89	0.73	5.84	2.50	8.34	118.0
400	92	0.94	0.71	7.27	2.84	10.11	146.0
800	94	0.96	0.77	4.26	2.94	7.22	144.4
CD 5%	—	—	—	—	0.26	1.98	19.5
CD 1%	—	—	—	—	—	2.73	—
<i>H. binata</i>							
Control	82	2.49	1.56	5.14	0.79	5.93	592.8
100	68	2.55	1.58	1.42	0.64	2.05	563.6
200	90	2.43	1.47	0.99	0.59	1.58	518.4
400	84	2.41	1.48	0.96	0.40	1.36	502.6
800	92	2.43	1.51	0.88	0.68	1.56	548.6
CD 5%	—	—	—	1.39	0.15	1.47	—
CD 1%	—	—	—	—	—	2.03	—

Gamma-irradiation of seeds of arid zone tree species does influence some of the seedling characteristics in a positive manner but to ascertain that these induced useful mutations are permanent and transmissible to future generations, long term testing is required, only then one can arrive at concrete conclusion.

References

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