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REVERSAL OF ABA-INDUCED INHIBITION OF LETTUCE SEED GERMINATION BY HOMOEOPATHIC REMEDIES

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Exogenous and endogenous abscisic acid (ABA) play a preventive role in the germination of seeds (Bewley & Black, 1982; Berrie, 1984; Khan & Andveob, 1993). Exogenous application of ABA inhibits the germination of both non-dormant seeds and seeds whose dormancy has been broken by various treatments (Addicott & Lyon, 1969; Milborrow, 1974). The ABA-induced inhibition of seed germination and seedling growth is known to be counteracted by Gibberellic acid (GA_3) and kinetin (Kabar, 1997; Sankhla & Sankhla, 1968). In the present study lettuce (*Lactuce sativa* cv. Grand Rapids) seeds after 2 days of germination at 20°C showed 54% inhibition by 6 μM and 84% by 8 μM ABA treatments (Table 1). Soaking lettuce seeds in ABA prevents germination by blocking the action of plant hormones. For counteracting this ABA induced inhibition of seed germination, some homoeopathic remedies were tested.

Solutions of homoeopathic remedies viz., Bacillinum, Hamamelis virginiana, Mercurius solubilis, Natrium chloratum, Psorinum, Pyrogenium, Rhus toxicodendron, Silicea and Sulphur were prepared by mixing 0.5 ml of each in 3 ml of distilled water in a 9 cm diam., Petri dish on which a sheet of Whatman filter paper was placed. A 0.5 ml of ethanol in 3 ml of distilled water was used as control. These solutions were evaporated to dryness under a fan at room temperature (22 $\pm$ 2°C). Hundred seeds of lettuce were distributed on filter paper moistened with distilled water or solutions of 6 μM and 8 μM abscisic acid (ABA). The dishes were kept in an incubator at 20°C in 12 h cycle of light and dark. After 48 hours, germination was recorded taking the emergence of radicle as an indication of germination.

Thirty centesimal potency of Bacillinum, Hamamelis and Psorinum were found to completely overcome the inhibition induced by low concentration of ABA (6 μM) while 34-94% inhibition was reduced by Pyrogenium, Sulphur, Silicia, Rhus toxicodendron, Mercurius solubilis and Natrium chloratum. When 8 μM ABA was used together with the homoeopathic remedies all except Natrium chloratum and Silicea significantly reverted the ABA induced inhibition of lettuce seed germination but to a lesser degree (Table 1).

In another experiment 6, 30, 200 and 1000 centesimal potencies of Merc Sol., Nat. chloratum, Rhus tox., and Silicea obtained from Willmar Schwabe of Germany were used to determine whether the ABA induced inhibition of lettuce seed germination counteracted by some homoeopathic remedies is potency dependent or not. All the potencies of the four remedies were found equally capable of reverting the ABA-induced inhibition of seed germination (Table 2). Increasing potencies in some cases was found to enhance the counteracting effect of germination inhibition induced by 6 μM ABA but this pattern was completely absent when 8 μM ABA was used. In the germination model proposed by Khan (1968, 1971) on the role of plant hormones in

Table 1. Effect of ABA alone or in combination with thirty centesimal potency of homeopathic remedies on the germination of *Lactuca sativa* cv. Grand Rapid seeds after 48 hrs of incubation at 20 ± 1°C.

Treatment	6 μM ABA			8 μM ABA		
	%Ger.	%Inh.*	%Rev.**	%Ger.	%Inh.	%Rev.**
Control (No ABA)	93.0^{a}±0.51	—	—	93.0^{a}±0.5	—	—
ABA	43.0^{g}±3.0	54.0	—	15.0^{e}±3.0	84.0	—
Baci. 30 + ABA	97.0^{a}±1.0	—	108.0	35.0^{cd}±1.0	62.4	26.0
Ham.30 + ABA	97.0^{a}±1.0	—	108.0	65.0^{b}±3.0	30.1	64.0
M. sol. 30 + ABA	69.0^{e}±1.0	26.0	52.0	62.0^{b}±4.0	33.3	60.2
Nat. chl. 30 + ABA	60.0^{f}±2.0	36.0	34.0	15.0^{e}±3.0	84.0	—
Psor. 30 + ABA	94.0^{a}±2.0	-	102.0	57.0^{b}±3.0	39.0	54.0
Pyro. 30 + ABA	90.0^{ab}±4.1	3.2	94.0	35.0^{cd}±3.0	62.4	26.0
Rhus. tox. 30 + ABA	76.0^{d}±2.0	18.3	66.0	42.0^{c}±4.0	55.0	35.0
Silicea 30 + ABA	81.0^{cd}±2.0	13.0	76.0	15.0^{e}±3.0	84.0	—
Sulphur 30 + ABA	84.0^{bc}±2.0	10.0	82.0	31.0^{d}±3.0	67.0	21.0

Means within a column followed by different letters are significantly different at 0.05 level by Duncan's multiple range test.

$$* \%\text{Inhibition} = \frac{\text{Control-Treatment}}{\text{Control}} \times 100 \quad ** \%\text{Reversal} = \frac{(\text{Inhibitor} + \text{Reverting agent}) - \text{Inhibitor}}{\text{Control-Inhibitor}} \times 100$$

seed germination, it was stated that abscisic acid (ABA) plays a preventive role and cytokinin removes this blockage. The present study would suggest that ABA-induced inhibition of lettuce seed germination can be counteracted by a number of homoeopathic remedies in a way similar to that of phytohormones.

Table 2. Effect of ABA alone or in combination with 6, 30, 60 and 1000 centesimal potencies of homoepathic remedies on the germination of *Lactuca sativa* cv. Grand Rapid seeds after 48 hrs of incubation at 20 ± 1°C.

Treatment	6 μM ABA			8 μM ABA		
	%Ger.	%Inh.*	%Rev.**	%Ger.	%Inh.	%Rev.**
			Mercurius solubilis			
Control (No ABA)	$93.0^{a}\pm0.51$	—	—	$93.0^{a}\pm0.5$	—	—
ABA	$43.0^{e}\pm3.0$	54.0	—	$15.0^{d}\pm3.0$	84.0	—
Merc. sol. 6 + ABA	$97.0^{d}\pm1.0$	39.0	28.0	$69.5^{b}\pm1.0$	26.0	69.2
Merc. sol. 30 + ABA	$69.0^{c}\pm1.0$	26.0	52.0	$62.0^{b}\pm4.0$	33.3	60.2
Merc. sol. 200 + ABA	$86.0^{ab}\pm1.0$	7.5	86.0	$50.5^{c}\pm4.0$	46.2	45.0
Merc. sol. 1000 + ABA	$81.5^{b}\pm2.0$	13.0	76.0	$41.5^{c}\pm3.0$	56.0	33.3
			Natrium chloratum			
Nat. chl. 6 + ABA	$46.0^{d}\pm1.0$	51.0	6.0	$8.0^{c}\pm1.0$	91.3	—
Nat. chl. 30 + ABA	$60.0^{c}\pm2.0$	36.0	34.0	$15.0^{bc}\pm3.0$	84.0	—
Nat. chl. 200 + ABA	$68.0^{b}\pm2.0$	27.0	50.0	$18.5^{b}\pm2.0$	81.0	4.0
Nat. chl. 1000 + ABA	$69.5^{b}\pm1.5$	26.0	52.0	$15.0^{bc}\pm3.0$	84.0	—
			Rhus. toxicodendron			
Rhus. tox.6 + ABA	$85.5^{b}\pm3.0$	9.0	84.0	$32.5^{b}\pm4.0$	66.0	22.0
Rhus. tox. 30 + ABA	$76.0^{c}\pm2.0$	18.3	66.0	$42.0^{b}\pm4.0$	55.0	35.0
Rhus. tox. 200 + ABA	$92.5^{a}\pm0.0$	1.1	98.0	$42.0^{b}\pm6.1$	55.0	35.0
Rhus. tox. 1000 + ABA	$65.5^{d}\pm1.0$	30.0	44.0	$41.0^{b}\pm1.0$	56.0	33.3
			Silicea			
Silicea 6 + ABA	$75.5^{b}\pm3.0$	19.3	64.0	$22.0^{c}\pm2.0$	76.0	9.0
Silicea 30 + ABA	$81.0^{b}\pm2.0$	13.0	76.0	$15.0^{c}\pm3.0$	84.0	—
Silicea 200 + ABA	$77.0^{b}\pm2.0$	17.0	68.0	$35.5^{b}\pm2.1$	62.4	26.0
Silicea 1000 + ABA	$51.5^{c}\pm3.0$	45.2	16.0	$33.0^{b}\pm3.0$	64.5	23.0

Means within a column followed by different letters are significantly different at 0.05 level by Duncan's multiple range test.

*, **, as in Table 1.

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