

Effect of high dilutions of *Arsenicum album* on wheat seedlings from seed poisoned with the same substance

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Abstract

A blind laboratory experiment was carried out to show the effect of a 45x potency of *Arsenicum album* (As_2O_3) on wheat seedlings whose seeds had been previously poisoned with a material dose of the same substance. The effect of the homoeopathic treatment on stem growth was statistically significant. The experimental results were matched with a previous study concerning homoeopathic treatment in the same species.

Introduction

In a previous paper¹ we showed that potencies of *Arsenicum album* (As_2O_3) have a statistically significant effect in a wheat germination model and that differences between treatment groups cannot be said to be due to intrinsic seed variability only. The 40x and 45x potencies seemed to have a relevant effect on wheat germination.

The present study involved a more detailed experiment using only the 45x potency with the aim of verifying whether homoeopathic treatment has a statistically significant effect, not only on seed germination but also on seedling growth. Moreover, we wanted to add to the quantitative results of the previous study a qualitative assessment of the effects of homoeopathic treatment on the morphological features of the seedlings.

In our design, the treated seedlings had been poisoned with sublethal quantities of the same substance to establish whether there was amplification of homoeopathic treatment according to Hahnemann's law of similars which states that 'like cures like' and has been repeatedly discussed (for recent ideas on the subject see Oberbaum and Cambar²). Such an experimental model, based on previous poisoning of plants, has been used by a number of authors since the 1960s. Relevant

contributions have been provided by Netien,³ Boiron and Marin,⁴ Noiret and Glaude,⁵ Auquière et al.,⁶ Scofield,⁷ Progetti et al.⁸ For a theoretical review on self-recovery according to the law of similars see also Van Wijk and Wiegant.⁹

Materials and methods

Trial design

The experiment was carried out from November 1993 to February 1994, using unbroken MEC wheat seeds selected for uniform size, shape and colour. Each seed was fixed to the centre of the upper part of a piece of filter paper with a uniformly sized piece of clay. The paper was inserted in a transparent cellophane envelope (12 x 20 cm) which was placed in a larger cardboard envelope, so that stems and roots could develop in natural light and darkness respectively. The temperature was maintained between 16 °C and 20 °C.

The number of seeds used for the experiment was 360, 60 of which were treated with distilled water, without prior stress (control group, denoted with C). The second group of 150 seeds was stressed and then treated with distilled water (poisoned group, P+0). The third group of 150 seeds was stressed and then treated with As_2O_3 45x, prepared as described by Betti et al.¹ (treated group, P+T). To define the right dosage of *Arsenicum album* for the stress, we tested arsenic dilutions from 0.02% to 0.20% for different exposure times (from 30 to 120 minutes), choosing the highest sublethal dose, which proved to be 0.1% for 30 minutes, followed by rinsing in tap water for 60 minutes. Then 3.2 ml of water or As_2O_3 45x was put in each envelope.

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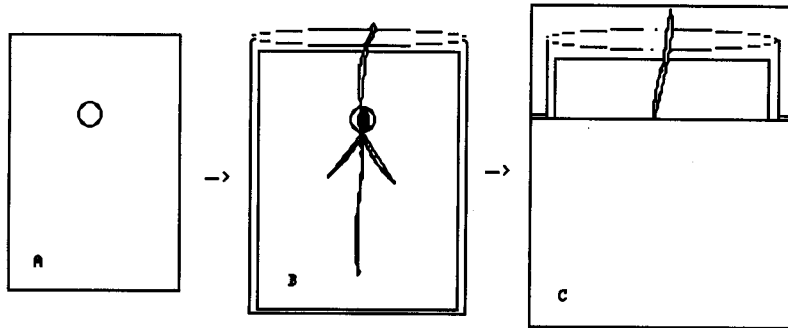


FIGURE 1. Experimental setup for wheat germination. A) Small piece of clay attached to filter paper; B) filter paper inserted in transparent cellophane envelope, with the seed held in place by the clay; C) cellophane envelope placed in larger cardboard envelope to allow stalks and roots to develop in natural light and darkness respectively.

Starting from the end of the second day, each root and stem was measured every 24 hours, up to the 7th day of observation, using a single blind protocol.

Statistical analysis

For each seedling the length of the stem and the sum of the lengths of the primary and secondary roots were recorded each day. We described average daily growth with histograms and the percentage weights of the different parts of overall seedling length using pie charts. The distribution symmetry was tested with Pearson's Gamma index

$$\gamma = \frac{M [X - M(X)]^3}{[S(X)]^3}$$

where M and S = average and standard deviation respectively. The number of observations being quite large, we decided to apply the Student's *t* test for comparison between the effects of different treatments on average length. This procedure was repeated for each day of observation.

Results

First of all, we noted that poisoning caused marked inhibition of seedling growth, in all parts of the plant, with the average length registered in group C at the end of the experiment distinctly greater than the corresponding values for the P+0 and P+T groups, as shown in Table 1. Comparing groups C and P+0, inhibition was almost 60% for the stem and about 30% for the roots. On the other hand, the only clear difference between groups P+0 and P+T concerned the stems, which were 24% longer in group P+T, while the roots showed similar average lengths in both groups.

Analysing the percentage composition of different parts of the seedling (Figure 2), we recorded greater stem weight (15.6%) in group C; the weight fell to 10.1% in group P+0; treatment with As_2O_3 45x took this value closer to group C (12.4%).

As the most marked effect of the homeopathic treatment was found to relate to stem length, we studied this in particular detail. The histogram in Figure 3 summarizes average stem length after 4, 5, 6 and 7 days

	C	P+0	P+T	Difference (%)		
				P+0 vs C	P+T vs C	P+T vs P+0
Stem	76.37	31.74	39.37	-58.44	-48.45	24.04
Primary root	146.70	91.59	90.79	-37.57	-38.11	-0.87
Secondary root	265.10	189.27	188.42	-28.55	-28.98	-0.61
Total	488.17	312.75	318.43	-35.93	-34.77	1.82

TABLE 1. Average length (mm) after 7 days. C = control, P+0 = poisoned and P+T = treated group.

Days	P+0	P+T	Difference (%)	Student's <i>t</i>	Significance (%)
4	8.21	9.31	13.40	1.700	4.46
5	14.85	17.73	19.39	2.505	0.62
6	22.61	27.59	22.03	2.903	0.19
7	31.74	39.37	24.04	3.292	0.05
Pearson Index	-0.115	0.052			

TABLE 2. Difference in average length of stem (mm) between P+0 = poisoned and P+T = treated group.

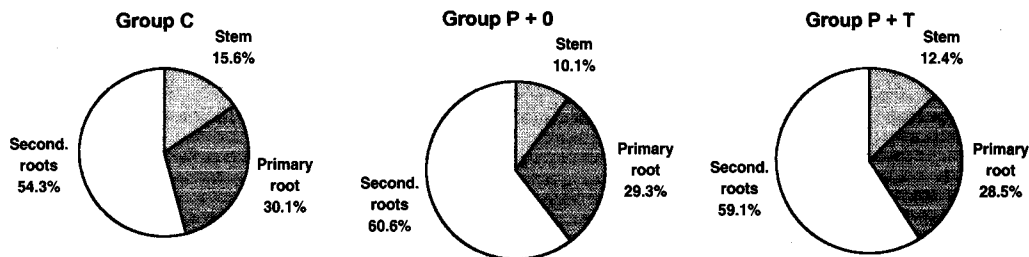


FIGURE 2. Pie chart showing seedling composition after 7 days of observation. C = control, P+0 = poisoned and P+T = treated group.

for each group. It can easily be seen that group P+T always showed values intermediate between C and P+0 (even if closer to P+0), and the difference from the P+0 group increased with time. We also studied the statistical significance of the difference between P+T and P+0. The results are shown in Table 2. As the sample size was rather large (150

for both groups) and the distribution seemed to be unimodal and approximately symmetrical—Pearson's index of asymmetry was not far from zero—we were able to apply normal approximation and perform the classic Student's *t* test. We did this for average stem lengths for each day of observation, and progressive reduction in significance levels (from 4.46% to 0.05%) demonstrated that the tendency to recover increased with time.

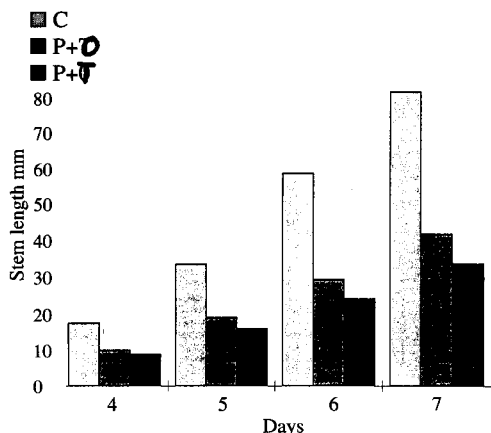


FIGURE 3. Time trend of average stem length in C = control, P+0 = poisoned and P+T = treated group.

Discussion

The study made it possible to assess the positive effect of As_2O_3 45x on wheat seedling growth when the seeds had been previously poisoned with material doses of the same substance. The effect is limited to the stem, which showed significant recovery increasing with treatment time, whereas root length was not influenced by the homoeopathic treatment. Comparing treated and poisoned groups from a qualitative point of view, we observed a tendency in treated plants to recover normal morphology, as described above for the percentage weights of stem and roots.

The positive effect obtained with As_2O_3 45x is consistent with earlier results concerning the action of the same homoeopathic potency of *Arsenicum album* on wheat seed

germination.¹ The crucial point of our study was clear confirmation of the significant effect of As_2O_3 45x seen in wheat seed germination without poisoning in 1991–93,¹ and in seedling growth of stressed seeds in 1993–94, as described here. The reliability of the results that can be obtained in botanical experiments with ultra high dilutions is the subject of a paper by Pongratz and Endler,¹⁰ who point out the importance of obtaining results that are consistent with previous experiments under similar conditions. Our study seems to follow this direction.

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