Droplet evaporation patterns of wheat seed leakages differ following treatments with arsenic at ultra-high dilution level

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ABSTRACT

Introduction: “Agro-homeopathy” plays an important role in sustainable agriculture providing cost-saving and residue-free plant treatments for the improvement of yield and the management of diseases and pests [1]. However, one of the main difficulties in “agro-homeopathy” is the exact choice of the right remedy and dilution, which requires the performance of many time-consuming trials.

The droplet evaporation method could constitute a screening method for evaluating the efficacy of extremely low doses and high dilutions on plants. Droplet patterns prepared out of wheat seed leakages show differences in their complexity in relation to the seed vigour [2]. Here we show that this structure-forming capacity of seed leakages prepared in water or in ultra-high diluted (UHD) solutions may give a reliable picture of the treatment’s stimulating or inhibiting influence on plant vitality.

Materials and Methods: Part of the seeds was stressed with 0.1% As₂O₃ (As) aqueous solution [3]. The droplet patterns were prepared out of four samples: non-stressed (ns) seeds in water, ns-seeds in As 45x, stressed (s) seeds in water, s-seeds in As 45x. The experiment was performed in a 3 day repetition, 3 replicates per day, and 5 droplets per each replicate. The resulting patterns were evaluated by means of the *ImageJ* software [4] for their local connected fractal dimension (LCFD) values. The plant vigour of the four samples was evaluated by means of *in vitro* wheat growth [5, 6].

Results: The mean LCFD of patterns deriving from s-seeds was significantly lower (1.4, standard error (SE) 0.04) vs. ns-seeds (1.7, SE 0.02). Moreover, for both ns- and s-seeds, the LCFD was significantly higher with treatment As 45x vs. water (1.8, SE 0.05 vs. 1.7, SE 0.03 for ns-seeds, and 1.5, SE 0.04 vs. 1.2, SE 0.05 for s-seeds). The results of the growth test showed a significant vigour decrease caused by As stress (shoot length 19.7mm, SE 1.2) vs. ns-seeds (22.4mm, SE 1.5); a significant stimulating effect following As 45x treatment was observed for both s-seeds (25.1mm, SE 1.1) and ns-seeds (31.4 mm, SE 1.3). Significant differences are at P<0.05.

Discussion: The droplet patterns seem to be a sensitive tool for visualizing the effectiveness of UHD on seeds. The experiment showed that the pattern complexity increased with the application of the treatment for both ns- and s-seeds. The growth test provided a further verification of these results.

Conclusions: Further confirmations are required, but even as it is now the droplet evaporation method may be considered a promising tool for “agro-homeopathic” screening tests.

Keywords: Droplet evaporation, patterns, wheat seeds, arsenic trioxide, ultra high dilutions.

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