

Reproducibility of effects of the homeopathic dilutions 14x – 30x of gibberellic acid on growth of *Lemna gibba* L.

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ABSTRACT

Background: Reproducibility of investigations in homeopathy is still challenging. Duckweed (*Lemna gibba* L.), a monocotyledonous waterplant which mostly reproduces vegetatively and therefore builds genetically identical clones, may be a suitable test system for standardised trials.

Aims: This study investigated if formerly observed effects of gibberellic acid 14x – 30x on growth of *Lemna gibba* were reproducible.

Methodology: Duckweed was grown in dilutions of gibberellic acid (14x–30x) as well as once succussed (c1) and unsuccussed (c0) water control. Area-related growth rate for day 0–7 was determined by a computerised image analysis system. Three series including five independent blinded and randomised experiments each were carried out in the same way as in the original study. Only time and conductor of experiments were modified. System stability was controlled by three series of systematic negative control (SNC) experiments with the same set-up, but distilled and autoclaved water was used as the only test substance. According to the series with gibberellic acid, each serie of SNC experiments included five experiments. Full two-way ANOVA ($\alpha = 5\%$) was used for statistical analysis. Independent variables were treatment and experiment number, dependent variable was $r_{(\text{area})}$ for day 0–7. Data of each experiment was normalised to its mean value to allow a better comparison between experiments. Only if the global ANOVA F-test was significant ($p < 0.05$) we compared the investigated groups with Fisher's LSD test (protected Fisher's LSD).

Results: No specific effects of agitated dilutions of gibberellic acid were found in the first two replication series ($p=0.263$ and $p=0.062$). In the third serie with gibbous *Lemna gibba* L. we observed a significant effect ($p=0.009$) of the homeopathic treatment, however growth was increased in contrast to decreasing in the former study. Variability in experiments with gibberellic acid 14x – 30x was lower than in SNC experiments. The stability of the experimental system was verified by the SNC experiments.

Conclusions: When designing new studies to investigate reproducibility, different physiological states of the test organism must be considered. Variability might be an interesting parameter to investigate effects of homeopathic remedies in basic research.

Keywords: Homeopathy, plants, *Lemna gibba*, reproducibility.



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