

DUAL EFFECTS OF ABSCISIC ACID ON THE GROWTH OF A DUCKWEED

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The plant hormone abscisic acid (ABA) is believed to be a dormancy factor in some seeds and buds; it often inhibits growth of plant organs⁽³⁾. We found that ABA had dual effects on a duckweed tested (*Lemna gibba* L.). In these experiments, *Lemna gibba* plants were cultured under aseptic conditions on liquid E medium (containing minerals and sucrose) to which graded concentrations of ABA were added⁽²⁾, and incubated in a growth chamber which gave continuous illumination from a bank of fluorescent tubes. The temperature was set at 28°C. The growth was measured 9 days after inoculation. The result shows that ABA at 10⁻⁶M and above severely suppressed growth and multiplication of fronds (the green leaf-like vegetative structures); at 10⁻⁷M it permitted formation of miniature fronds (or turions), with subsequent expansion of fronds halted, and there was little increase in fresh weight; at 10⁻⁸M, 10⁻⁹M, and 10⁻¹⁰M, ABA greatly enhanced growth: number of fronds, fresh weight, and dry weight all increased (Table 1).

Table 1. Effects of Abscisic Acid on the Growth of *Lemna gibba*

Conc. of ABA	No. of fronds*	fresh wt. (mg)	dry wt. (mg)
0	159	514.5	31.8
10 ⁻¹⁰ M	264	1155.5	68.7
10 ⁻⁹ M	327	1271.0	77.7
10 ⁻⁸ M	384	1115.0	90.5
10 ⁻⁷ M	297	647.0	57.2
10 ⁻⁶ M	45	141.0	30.3
10 ⁻⁵ M	24	124.0	32.1
10 ⁻⁴ M	33	121.5	27.6

* Started with 20 fronds, scored after 9 days incubation. The result of a representative experiment.

It should be added that although ABA at 10⁻⁶M greatly reduced the number of fronds and fresh weight increase, it had little effect on dry weight. ABA presumably had no effect on photosynthesis and deposition of dry matter.

It appears that the formation of a new frond through budding consists of two steps: cell division in the meristematic zone, giving rise to a small bud; second, cell expansion in the bud. Our data seem to suggest that at 10⁻⁶M and above, ABA inhibits cell division; at 10⁻⁷M ABA permits cell division without cell expansion; at 10⁻⁸M ABA promotes both formation and subsequent expansion of new fronds. It thus appears by selecting the proper concentrations of ABA, one can modulate growth and the behavior of cells in experimental plants such as duckweeds.

Although *L. gibba* is extremely sensitive to ABA (10⁻¹⁰M being effective in promoting growth), the dual nature of ABA's effect plus the fact that benzyladenine and indoleacetic acid

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also enhance growth (unpublished) makes it impractical for bioassay. The authors wish to thank Dr. Charles F. Cleland for generous gift of *Lemna gibba* culture used in this investigation.

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