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How Long Do Plants Remember? Transgenerational Stress Memory in a Duckweed-Aphid System

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Transgenerational plasticity is considered a flexible and rapid adaptive mechanism that enables organisms to respond to environmental change over relatively short evolutionary timescales. However, how long these effects persist and the extent to which they influence organismal fitness remain largely unknown. Here, we investigated these questions using the giant duckweed (*Spirodela polyrrhiza*) and its native herbivore, the waterlily aphid (*Rhopalosiphum nymphaeae*). We exposed clonal duckweed lineages to aphid herbivory for ten consecutive generations and subsequently allowed them to recover under herbivore-free conditions for 1, 3, 5, 7, or 9 generations. We then grew the descendants in the presence and absence of aphids to assess their transgenerational responses. Duckweed exhibited a remarkably persistent stress memory: the ancestral herbivory environment fundamentally altered the growth of descendant fronds across multiple subsequent generations. Ancestral aphid feeding enhanced plant growth in the absence, but not the presence, of renewed herbivory. This pattern suggests that previously stressed plants overcompensate by accelerating growth once herbivore pressure is removed, rather than by increasing resistance to recurring attack. Remarkably, ancestral aphid herbivory also enhanced aphid fitness, even after nine generations without herbivore exposure. Together, these findings demonstrate that duckweed possesses a long-lasting, multigenerational stress memory that herbivores may exploit to their own advantage.

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References

Huber et al., 2021; Proc. R. Soc.

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