

Elevated carbon dioxide impairs the performance of a specialized parasitoid on Brassica plants

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Elevated concentrations of atmospheric carbon dioxide (CO₂), a consequence of anthropogenic global change, may profoundly interfere with tritrophic interactions. Such effects have rarely been investigated. We used the system composed of Brassica plants, the cabbage aphid *Brevicoryne brassicae* and the endoparasitoid *Diaeretiella rapae* to compare effects of elevated CO₂ (800 ppm) versus ambient CO₂ (400 ppm). Plants were exposed to the CO₂ concentrations for up to 10 weeks, aphids for 2-3 generations, and parasitoids for 1 generation. Concomitant bioassays with herbivore-infested plants exposed to parasitoids were also conducted. A significantly lower proportion of aphids were parasitized under elevated compared to ambient CO₂. Parasitoid progeny emerged earlier but offspring adults were shorter lived under elevated CO₂. Plant glucosinolate concentrations were higher under elevated compared to ambient CO₂. However, contrary to expectations, aphid glucosinolate concentrations were significantly lower under elevated CO₂. Likewise aphid body mass remained approximately 20% lower under elevated compared to ambient CO₂. Thus, elevated CO₂ seems to have enhanced plant direct defense through an increase in natural plant defense compounds, but also led to a reduction in indirect defense through decreased parasitism and parasitoid longevity. Our results indicate, for the first time, a conflict between bottom-up and top-down control under elevated CO₂.

