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

Adriana Najar-Rodriguez [*1], Jeannine Klaiber [2], Silvia Dorn [2]

[1] Previous Address: ETH Zurich, Switzerland. Current Address: Plant and Food Research, Palmerston North
[2] ETH Zurich, Switzerland

Elevated concentrations of atmospheric carbon dioxide (CO_2), 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 CO_2 (800 ppm) versus ambient CO_2 (400 ppm). Plants were exposed to the CO_2 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 CO_2. Parasitoid progeny emerged earlier but offspring adults were shorter lived under elevated CO_2. Plant glucosinolate concentrations were higher under elevated compared to ambient CO_2. However, contrary to expectations, aphid glucosinolate concentrations were significantly lower under elevated CO_2. Likewise aphid body mass remained approximately 20% lower under elevated compared to ambient CO_2. Thus, elevated CO_2 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 CO_2.