Change your diet: How CO2, plant phenology and genotype alter grapevine quality and affect performance and larval transcriptome of an insect herbivore

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Résumé

Herbivorous insects need to cope with changing host plant biochemistry caused by abiotic and biotic impacts, to meet their dietary requirements. Larvae of the multivoltine European grapevine moth *Lobesia botrana*, one of the main insect pests in viticulture, feed on both flowers and berries. The nutritional value and defense compounds of these organs are changing with plant phenology and are affected by climate change which may accordingly alter plant-insect interactions. Here, we assessed the impacts of future elevated atmospheric CO2 concentrations on host plant quality of different grapevine organs, on *L. botrana* larval performance as well as the larval transcriptome.
Using the Geisenheim VineyardFACE facility, where 'Riesling' and 'Cabernet Sauvignon' were cultivated in the field under ambient or elevated (ca. +20%) atmospheric CO2 concentrations, we found that nutrient (amino acids, sugars) and defense compound (phenolic compounds) concentrations of inflorescences and ripening berries differed strongly due to plant phenology and less due to cultivar and CO2 concentration. Assessing global gene expression after feeding on the respective organs, we found that larval transcriptomic plasticity largely mirrored the plant biochemical plasticity. Larval relative growth rate differed between treatments in a plant phenology-dependent manner. Grape berries contained higher amino acid concentrations and altered phenolics profiles after larval feeding.
In the near future, the grapevine-*L. botrana* interaction will probably change less due to elevated CO2 concentrations than it does currently during one season. Changes associated to plant phenology, however, may be relevant for contemporary pest management.

Mots-Clés: European grapevine moth, Lobesia botrana, Vitis vinifera, bottom, up effect, top, down effect, phenolic acids, flavonoids, phenolamides, RNA, Seq

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