Climate Change Modulates Multitrophic Interactions Between Maize, A Root Herbivore, and Its Enemies

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 4638102
Author(s) Guyer, Anouk; van Doan, Cong; Maurer, Corina; Machado, Ricardo A. R.; Mateo, Pierre; Steinauer, Katja; Kesner, Lucie; Hoch, Günter; Kahmen, Ansgar; Erb, Matthias; Robert, Christelle A. M.
Author(s) at UniBasel Kahmen, Ansgar ; Hoch, Günter ;
Year 2021
Title Climate Change Modulates Multitrophic Interactions Between Maize, A Root Herbivore, and Its Enemies
Journal Journal of chemical ecology
Volume 47
Number 10-11
Pages / **Article-Number** 889-906
Keywords Climate change; Entomopathogenic nematodes; Maize; Multitrophic interactions; Root herbivory
Mesh terms Animals; Climate Change; Coleoptera, growth & development, physiology; Food Chain; Larva, growth & development, physiology; Strongyloidea, physiology; Zea mays, growth & development, physiology
How climate change will modify belowground tritrophic interactions is poorly understood, despite their importance for agricultural productivity. Here, we manipulated the three major abiotic factors associated with climate change (atmospheric CO2, temperature, and soil moisture) and investigated their individual and joint effects on the interaction between maize, the banded cucumber beetle (Diabrotica balteata), and the entomopathogenic nematode (EPN) Heterorhabditis bacteriophora. Changes in individual abiotic parameters had a strong influence on plant biomass, leaf wilting, sugar concentrations, protein levels, and benzoxazinoid contents. Yet, when combined to simulate a predicted climate scenario (Representative Concentration Pathway 8.5, RCP 8.5), their effects mostly counter-balanced each other. Only the sharp negative impact of drought on leaf wilting was not fully compensated. In both current and predicted scenarios, root damage resulted in increased leaf wilting, reduced root biomass, and reconfigured the plant sugar metabolism. Single climatic variables modulated the herbivore performance and survival in an additive manner, although slight interactions were also observed. Increased temperature and CO2 levels both enhanced the performance of the insect, but elevated temperature also decreased its survival. Elevated temperatures and CO2 further directly impeded the EPN infectivity potential, while lower moisture levels improved it through plant- and/or herbivore-mediated changes. In the RCP 8.5 scenario, temperature and CO2 showed interactive effects on EPN infectivity, which was overall decreased by 40%. We conclude that root pest problems may worsen with climate change due to increased herbivore performance and reduced top-down control by biological control agents.
ISSN/ISBN 1573-1561
edoc-URL https://edoc.unibas.ch/86776/
Full Text on edoc No;
Digital Object Identifier DOI 10.1007/s10886-021-01303-9
PubMed ID http://www.ncbi.nlm.nih.gov/pubmed/34415498
ISI-Number 000686880700002

Document type (ISI) Journal Article