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Future rainfall patterns reduce arthropod abundance in model arable agroecosystems with different soil types

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Climate change scenarios for eastern Austria predict a seasonal shift in precipitation patterns with fewer but heavier rainfall events and longer drought periods during the growing season and more precipitation during winter. This is expected to alter arthropods living in natural and agricultural ecosystems with consequences for several ecosystem functions and services. In order to better understand the effects of future rainfall patterns on aboveground arthropods inhabiting an agroecosystem, we conducted an experiment where we simulated rainfall patterns in model arable systems with three different soil types. Experiments were conducted in winter wheat cultivated in a lysimeter facility near Vienna, Austria, where three different soil types (calcaric phaeozem, calcic chernozem and gleyic phaeozem) were subjected to long-term current vs. predicted rainfall patterns according to regionalized climate change projections for 2071-2100. Aboveground arthropods were assessed by suction sampling in April, May and June 2012. We found significant differences in mean total arthropod abundances between the sampling dates with 20 ± 2 m^{-2}, 90 ± 20 m^{-2} and 289 ± 54 m^{-2} in April, May and June, respectively. Across all three sampling dates, future rainfall patterns significantly reduced the abundance of Araneae (spiders; -43%), Auchenorrhyncha (cicadas, leafhoppers, spittlebugs, -39%), Coleoptera (beetles, -48%), Carabidae (ground beetles, -41%), Chrysomelidae (leaf beetles, -64%), Collembola (springtails, -58%), Diptera (flies, hoverflies, -75%) and Neuroptera (lacewings, -73%). Generally, different soil types had no effect on the abundance of arthropods. The diversity of arthropod communities was unaffected by rainfall patterns or soil types. Correlation analyses of arthropod abundances with crop biomass, weed density and abundance suggest that rainfall patterns indirectly affected arthropods via changes on crops and weeds. Taken together, these results show that future rainfall patterns will have detrimental effects on the abundance of a variety of aboveground arthropods in winter wheat with potential consequences for their role as herbivores, biological control agents or food source for predatory fauna within agroecosystems.

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