GENERAL INFORMATION

author(s)	De Frenne P, Graae BJ, Kolb A, Brunet J, Chabrerie O, Cousins SAO, Decocq G, Dhondt R, Diekmann M, Eriksson O, Heinken T, Hermy M, Jõgar Ü, Saguez R, Shevtsova A, Stanton S, Zindel R, Zobel M, Verheyen K
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ABSTRACT

Climate warming is already influencing plant migration in different parts of the world. Numerous models have been developed to forecast future plant distributions. Few studies, however, have investigated the potential effect of warming on the reproductive output of plants. Understorey forest herbs in particular, have received little attention in the debate on climate change impacts.

This study focuses on the effect of temperature on sexual reproductive output (number of seeds, seed mass, germination percentage and seedling mass) of *Anemone nemorosa* L., a model species for slow colonizing herbaceous forest plants. We sampled seeds of *A. nemorosa* in populations along a 2400 km latitudinal gradient from northern France to northern Sweden during three growing seasons (2005, 2006 and 2008). This study design allowed us to isolate the effects of accumulated temperature (Growing Degree Hours; GDH) from latitude and the local abiotic and biotic environment. Germination and seed sowing trials were performed in incubators, a greenhouse and under field conditions in a forest. Finally, we disentangled correlations between the different reproductive traits of *A. nemorosa* along the latitudinal gradient.

We found a clear positive relationship between accumulated temperature and seed and seedling traits: reproductive output of *A. nemorosa* improved with increasing GDH along the latitudinal gradient. Seed mass and seedling mass, for instance, increased by 9.7 % and 10.4 %, respectively, for every 1000°C h increase in GDH. We also derived strong correlations between several seed and seedling traits both under field conditions and in incubators. Our results indicate that seed mass, incubator-based germination percentage (Germ%Inc) and the output of germinable seeds (product of number of seeds and Germ%Inc divided by 100) from plants grown along a latitudinal gradient (i.e. at different temperature regimes) provide valuable proxies to parameterize key population processes in models.

We conclude that (1) climate warming may have a pronounced positive impact on sexual reproduction of *A. nemorosa* and (2) climate models forecasting plant distributions would benefit from including the temperature sensitivity of key seed traits and population processes.

MATERIALS & METHODS

study area	5l (seed collection), 6b (common garden)
time period	May 2008 (Aelmoeseneie)
goal	Test whether temperature along the latitudinal gradient has a direct effect on a wide range of reproductive traits from seed output to seedling emergence of *A. nemorosa*. - what is the importance of accumulated temperature for reproductive output compared to latitude and local abiotic and biotic environmental factors? - which correlations exist between these reproductive traits and which traits can be used in climate warming models?
set-up	indirect space-for-time substitution - 7 regions along a 2400 km latitudinal gradient - 1-6 populations for data collection in 2005, 2006, 2008
data collection	population variables - number of growing degree hours above 5°C - latitude - percentage of canopy cover - soil moisture in four classes - soil cores (0-4 cm): pH, P, K, Ca, Mg - population size - population density seed production and germination - diaspores of 15–20 randomly chosen individuals, air-dried - total number of seeds and mean seed mass per sampled plant - germination of 50 seeds per population (warm-cold-warm stratification) seed sowing experiment - 2006 and 2008 - common garden Denmark, Belgium - number and dry mass of seedlings
remarks	

RESULTS

Seed and seedling mass increased with accumulated temperature (Growing Degree Hours); seeds of warm grown parent plants had a higher germination percentage, and their seedlings had a larger biomass. Seed mass was negatively correlated with seed number and positively with seedling mass.