## GENERAL INFORMATION

| | |
|---|---|
| **author(s)** | De Frenne P, Graae BJ, Kolb A, Shevtsova A, Baeten L, Brunet J, Chabrerie O, Cousins SAO, Decocq G, Dhondt R, Diekmann M, Gruwez R, Heinken T, Hermy M, Öster M, Saguez R, Stanton S, Tack W, Vanhellemont M, Verheyen K |
| **year** | 2011 |
| **English title** | An intraspecific application of the leaf-height-seed ecology strategy scheme to forest herbs along a latitudinal gradient |
| **original title** | |
| **reference** | Ecography 34 |
| **pages** | 132–140 |
| **type** | article (a1) |
| **ecosystem service** | supporting - biodiversity |
| **keywords** | herb layer – global warming |
| **taxa** | *Anemone nemorosa, Milium effusum* |
| **project** | PhD_DeFrenne |
| **supervisor(s)** | Verheyen K, Hermy M, Graae BJ |
| **institution** | Ghent University, Laboratory of Forestry |
| **document** | pdf, hardcopy |
| **data** | |

## ABSTRACT

We applied the leaf-height-seed (LHS) ecology strategy scheme (a combination of three ecologically important traits: specific leaf area (SLA), seed mass and plant height) intraspecifically to two widespread European forest herbs along a latitudinal gradient. The aims of this study were to quantify LHS trait variation, disentangle the environmental factors affecting these traits and compare the within-species LHS trait relationships with latitude to previously established cross-species comparisons.

We measured LHS traits in 41 *Anemone nemorosa* and 44 *Milium effusum* populations along a 1900-2300 km latitudinal gradient from N France to N Sweden. We then applied multilevel models to identify the effects of regional (temperature, latitude) and local (soil fertility and acidity, overstorey canopy cover) environmental factors on LHS traits. Both species displayed a significant 4 % increase in plant height with every degree northward shift (almost a two-fold plant height difference between the southernmost and northernmost populations). Neither seed mass nor SLA showed a significant latitudinal cline. Temperature had a large effect on the three LHS traits of *Anemone*. Latitude, canopy cover and soil nutrients were related to the SLA and plant height of *Milium*. None of the investigated variables appeared to be related to the seed mass of *Milium*.

The variation in LHS traits indicates that the ecological strategy determined by the position of each population in this three-factor triangle is not constant along the latitudinal gradient. The significant increase in plant height suggests greater competitive abilities for both species in the northernmost populations. We also found that the studied environmental factors affected the LHS traits of the two species on various scales: spring-flowering *Anemone* was affected more by temperature, whereas early-summer flowering *Milium* was affected more by local and other latitude-related factors. Finally, previously reported cross-species correlations between LHS traits and latitude were generally unsupported by our within-species approach.

## MATERIALS & METHODS

| | |
|---|---|
| **study area** | 5l (seed collection) |
| **time period** | 2008 |
| **goal** | Gain insight into the<br>- extent of variation in the three LHS traits along the latitudinal gradient<br>- the correlation between environmental factors and the variation in LHS traits<br>- possible difference between within-species relationships and cross-species comparisons |
| **set-up** | - *Anemone*: 7 regions, 1900 km latitudinal gradient<br>- *Milium*: 8 regions, 2300 km latitudinal gradient<br>- 2008: 6 populations of each species per region, in deciduous forests |
| **data collection** | LHS<br>- 15 randomly chosen individuals per population and species<br>- plant height<br>- seed mass (all seeds Anemone, subsample Milium)<br>- leaf area and mass of dry leaves<br>environmental variables<br>- number of growing degree hours above 5°C<br>- latitude<br>- percentage of canopy cover<br>- soil cores (0-4 cm): pH, P, K, Ca, Mg, C, N |
| **remarks** | |

## RESULTS

*Anemone* and *Milium* individuals growing in northern populations were significantly taller at maturity than individuals in more southerly laying populations. For *Anemone*, the height differences were mainly related to accumulated temperature. Canopy cover also affected the height of *Milium*: taller plants under an open canopy.

Seed mass and SLA were unrelated to latitude for *Milium*; the relationship was marginally significant for *Anemone*. The SLA of the two species decreased with increasing soil nutrients and, for *Anemone*, with increasing temperature. Seed mass of *Anemone* was positively affected by temperature, while none of the studied variables was correlated with the seed mass of *Milium*.

Seed mass and plant height were negatively correlated for *Anemone*; seed mass and SLA were negatively correlated for *Milium*. The other LHS traits were uncorrelated for *Anemone* and *Milium*.