GENERAL INFORMATION

author(s)	Vandepitte K
year	2009
English title	Genetic diversity and fitness of forest herbs in anthropogenic landscapes
original title	
reference	PhD thesis, K.U.Leuven, Leuven
pages	182
type	dissertation (d1)
ecosystem service	provisioning – genetic resources
keywords	forest herbs, habitat age, fragmentation, genetics, fitness
taxa	*Geum urbanum*, *Mercurialis perennis*, *Convallaria majalis*
project	PhD Vandepitte_2009
supervisor	Honnay O, Roldán-Ruiz I
institution	K. U. Leuven, Faculty of Sciences, Department Biology
location	pdf
data	

MATERIALS & METHODS

study area	3b (large population), 3e (small population)
time period	2006–2008
goal	Broaden our knowledge of the relative effects of local forest environment and landscape configuration on the genetic diversity and fitness of forest herbs.
set-up	see papers below
data collection	see papers below
remarks	C5: Patterns of sex ratio variation and genetic diversity in *Mercurialis perennis* (Vandepitte_etal_2010_PlantEc) C6: Reproductive consequences of mate quantity versus mate diversity in *Mercurialis perennis* (Vandepitte_etal_2009_ActOec)

ABSTRACT

The transformation of vast temperate forests into the present-day cultural landscapes strains biodiversity. Both the fragmented landscape configuration and the degradation of the local forest environment potentially erode the genetic diversity of forest plant species and compromise local persistence in the short term or, at least, limit the evolutionary potential to adapt. Low inter-fragment connectivity can impede pollen and seed flow among forests, which results in increased genetic divergence and reduced genetic variation, owing to genetic drift, inbreeding and, founder effects in isolated new fragments. Under suboptimal forest conditions, impediment of sexual life cycle completion may reduce local genetic variation.

To develop effective conservation tools it is crucial to broaden our knowledge of the genetic and fitness response patterns of forest herbs species to spatial, temporal and environmental heterogeneity. Three still relatively common forest herbs, chosen to represent large variation in clonality and mating system, were investigated in anthropogenic landscapes in Flanders (Belgium). AFLP and SSR were used to quantify genetic diversity. The relationship between reproduction and genetic diversity and the fitness consequences of within versus among population crosses were documented.

Forest fragmentation likely shaped the population genetics of *Geum urbanum*, a non-clonal, relatively well-dispersing herb. Gene flow towards less connected forest fragments seemed insufficient to offset genetic drift in small populations. The local forest environment and forest age did not affect population genetics.

Reduced genetic diversity and gene flow did, however, not significantly affect offspring fitness of small populations. Small and large populations showed no significant differences in fitness nor did mean fitness increase after outcrossing compared to selfing. Little fitness reduction was observed in crosses over large distances as would be expected if the negative consequences of inbreeding are absent or too small to outweigh those of outbreeding.

The genetic diversity of the rhizomatous dioecious *Mercurialis perennis* and the self-incompatible *Convallaria majalis*, on the other hand, were predominantly determined by local forest conditions as a result of human actions and natural environmental variability in the old forests these populations occurred. *M. perennis* populations in shady, relatively undisturbed forest conditions appeared more likely to maintain balanced sex ratios and moderate to high levels of genetic variation through recurrent recruitment from seed. The local degree of genetic similarity and the proximity of males had a relatively small effect on seed set, in agreement with the likely restricted pollen dispersal distances. In the few all-male populations consisting of a single clone no sexual recruitment is possible. Seed set and seed viability in among-population crosses did not increase relative to within-population crosses.

Most of the studied 'populations' of *C. majalis* actually consisted of a single genotype. Multiclonal populations mainly occurred in locations with a thin litter layer, suggesting a mediating role of the local forest environment in sexual lifecycle completion. In agreement with the self-incompatibility character of this species, monoclonal populations showed very low or even absent fruit set. Lack of sexual recruitment seems to have resulted in almost monoclonal populations with reduced or absent sexual reproduction, potentially constraining their long-term persistence. Although likely initially related to the influence of local forest conditions on genotypic variation, spatial isolation may exacerbate this process by preventing the inflow of compatible pollen to restore sexual reproduction.

The results obtained here suggest an influence of life-history traits on the potential impact of habitat fragmentation. Local forest conditions likely shape the genetic diversity of the two studied forest herbs, characterized by clonal growth and a probably naturally fragmented structure. Self-incompatibility seems to confer vulnerability to the fitness consequences of low genetic variation whereas no fitness consequences were associated with reduced genetic variation in the examined populations of a frequently selfing herb.

RESULTS

For the forest herbs with clonal growth, the genetic diversity was affected by the local forest conditions. For self-incompatible species, low genetic variation seemed to lower population fitness. For frequently selfing species, reduced genetic variation seemed to have no influence on fitness.