Clonal population structure and genetic variation of ramet-production traits in a clonal plant, *Cardamine leucantha*

Michiaki Tsujimoto

Abstract

In clonal plants, “genet”, originating from a single zygote expands spatially by placing physiologically independent clones, “ramets”. Therefore, a clonal plant population is characterized by the hierarchical individuality of a genet and a ramet. Using molecular markers, many studies have shown that populations of clonal plants consisted of one to few predominant genets and many small genets. These studies implied the variation in the size of genet may be derived from age variation of genets, spatial environmental heterogeneity, or demographic stochasticity. However, variations in the size of genets may also be dependent on specific characteristics of predominant genets. This study aimed to evaluate whether ramet production traits were determined genetically and whether predominant genets had specific characteristics compared with non-predominant ones (chapter 1).

In chapter 2, we determined the genetic structure of a natural population of a rhizomatous clonal herb, *Cardamine leucantha* [Brassicaceae] using a high resolution genetic marker, restriction site-associated DNA sequencing (RAD-seq). We identified multiple genets with high inequality in terms of genet size and patchy distribution. We compared different procedures of genet assignments using both RAD-seq and SSR analyses.

In chapter 3, we conducted a common garden experiment using *C. leucantha* ramets which derived from the population where we identified predominant and non-predominant genets to assess genetic variation of ramet-production traits. We detected significant genetic variation in rhizome length between genets, and the

difference resulted in the distinct patterns of spatial distribution of daughter ramets at least in the growth experiments.

In chapter 4, to estimate determinants of ramet-production traits in a natural population of *C. leucantha*, we examined effects of being a specific genet member and those of forest-floor microenvironments. We found that the variation of rhizome length in the common garden experiment was retained in a natural population at least four predominant genets. Effects of measured micro-environments were not significant in determining ramet-production traits.

In chapter 5, clonal population structures and ramet- and seed-production traits in four geographically distant populations were examined. Clonal diversity and genet structure were similar, but ramet- and seed-production traits varied among populations. Expected changes in population structure by differential clonal growth and seed recruitment were discussed.