Catabolic production in plants: significant influence for CHN isotopes in lipids and amino acids

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Seasonal variations in the $\delta^{13}C$ and δD values have been frequently found in plant leaf lipids [1, 2]. In this study, the $\delta^{13}C$ and δD values of lipids (*n*-alkanes, *n*-fatty acids, phytol, and sterols) and the $\delta^{15}N$ values of amino acids for leaves and flowers in the stone fruit plant *Cerasus lannesiana* were analyzed by GC/IRMS, to investigate the biological and environmental factors controlling the δ values of plant lipids.

Flowers are catabolically produced in this plant, because they bloomed during the leafless period in early-spring. This is well consistent with the elevation in the $\delta^{15}N$ value of flowers in early-spring compared with that of leaves in the mature leaf periods (summer-autumn). Seasonal variations in the $\delta^{13}C$ and δD values of plant leaves are significantly large (>10‰ for $\delta^{13}C$, >100‰ for δD), with a common trend that these δ values of spring leaves are close to those of the flowers, whereas the values in summer and autumn leaves are relatively far from those of the flowers (Fig.1). These results suggest that leaf lipids are catabolically produced primarily at leaf emergence in spring, and that anabolic lipid production allows much heterogeneity in the $\delta^{13}C$ and δD values of plant leaf lipids in summer-autumn.

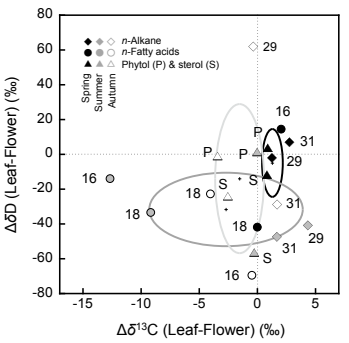

Fig. 1. Difference in the $\delta^{13}C$ and δD values of lipids between leaves (in spring, summer, and autumn) and flowers (in spring). Black filled, gray filled, and open symbols indicate spring, summer, and autumn of leaves (circle = mean and 1σ). The number indicates the carbon chain length of *n*-alkanes and *n*-fatty acids.

References

[1] Sessions 2006, Geochim Cosmochim Acta, 70, 2153-2162.

[2] Sachse et al. 2015, Isot Environ Health Stud, 51, 124-142.