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Studying the cause of the differential accumulation of C3 or C6-Oxygenated Monoterpenes in essential oil glands of Mint Species

Ahkami A.H, Johnson, Herron and Lange
Washington State University (WSU), USA

Various mint species are cultivated across the globe for their essential oils. The most abundant constituent of spearmint *(Mentha spicata)* oil is the monoterpene (-)-carvone. Water mint *(Mentha aquatica)*, in contrast, accumulates primarily (+)-menthofuran in the oil. A cross between watermint and spearmint led to the development of peppermint *(Mentha x piperita)*, which produces an oil rich in (-)-menthone and (-)-menthol, despite the fact that the oils of the parents do not contain these compounds above trace levels. The selfing of spearmint resulted in a progeny from which one line, termed Erospicata, was selected that contained high amounts of (-)-menthone but was essentially devoid of (-)-menthol. To evaluate the causes for the differences in essential oil composition among cultivars, we performed Illumina-based transcriptome analyses with glandular trichomes, the specialized anatomical structures responsible for the biosynthesis of essential oils, at different developmental stages. The transcripts for specific branch-point enzymes in the monoterpene pathway were differentially expressed in mint cultivars. For example, the gene encoding (-)-limonene 6-hydroxylase was expressed at very high levels in spearmint (which accumulates C6-oxygenated (-)-carvone), while (-)-limonene 3-hydroxylase transcript was highly abundant in other cultivars (which produce C3-oxygenated monoterpenes). Deep sequencing analyses revealed the main regions of sequence variations between seemingly inactive L6OH-like proteins in peppermint/watermint and active L6OH in spearmint which were in the substrate recognition sites and heme binding region. The implications of these findings and the possible roles of epigenetic mechanisms in the promoter regions of inactive genes involved in monoterpenoid pathway will be discussed.

Biography

Amir H. Ahkami has completed his Master from Tehran University, Iran, in the field of plant biotechnology and Ph.D. from the MLU of Halle-Wittenberg, Germany, in the field of plant molecular biology and biochemsitry. He is currently working in the Institute of Biological Chemistry (IBC) of Washington State University (WSU) as a postdoctoral research associate. His research area is mainly focused on the mechanisms of gene expression and biosynthesis of natural products in plants and metabolic engineering of commercially important terpenes. His review about metabolic engineering of monoterpenes, sesquiterpenes and diterpenes has been published recently.