# Interplay of carotenoid and anthocyanin metabolism during development and ripening of bilberry

Katja Karppinen[1,2], Laura Zoratti[1], Elisabete Carvalho[3], Stefan Martens[3], Hely Häggman[1] and Laura Jaakola[2,4]

[1] Genetics and Physiology Unit, University of Oulu, P.O. Box 3000, FI-90014 Oulu, Finland
[2] Climate laboratory Holt, Department of Arctic and Marine Biology, UiT the Arctic University of Norway, NO-9037 Tromsø, Norway
[3] Fondazione Edmund Mach, Research and Innovation Center, via E. Mach 1, 38010 S. Michele all'Adige, TN, Italy
[4] NIBIO, Norwegian Institute of Bioeconomy Research, P.O. Box 115, NO-1431 Ås, Norway

Development and ripening of fruits, stimulated by developmental and hormonal signals, include major metabolic and structural changes such as accumulation of pigments and flavor compounds. Recent studies have implicated that plant hormone abscisic acid (ABA), a carotenoid metabolism derivative, is a key regulator of ripening-related processes in non-climacteric fruits. Bilberry (*Vaccinium myrtillus* L.), also known as European blueberry, is a small fruit species rich with health-beneficial flavonoids, especially anthocyanins. Bilberry is one of the most abundant and economically important wild berry species in boreal forests of the Northern Europe.

Our research interests include investigations of the regulatory mechanisms related to ripening and anthocyanin biosynthesis in non-climacteric bilberry fruit. Our studies have shown that during the bilberry ripening, carotenoid biosynthesis is up-regulated while simultaneously the total carotenoid content decreases. This inconsistency is most likely due to apocarotenoid formation such as formation of ABA and berry flavor compounds during the berry ripening. At bilberry ripening, the increase in the expression of genes encoding carotenoid cleavage dioxygenases (CCDs) such as NCED1, the key enzyme in ABA biosynthesis, as well CCD1, the enzyme postulated in the production of flavor compounds, was detected. The ABA concentration was demonstrated to increase highly at the onset on fruit ripening preceding anthocyanin biosynthesis and accumulation. Exogenous ABA applied to the unripe bilberry fruits was in our study effective in inducing key anthocyanin biosynthetic genes leading to anthocyanin accumulation. This indicates that ABA plays an important role in the regulation of ripening and anthocyanin biosynthesis in bilberry fruit. Our study demonstrates that carotenoid and apocarotenoid metabolism has significant role in the bilberry fruit ripening and anthocyanin biosynthesis.