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Alterations in wheat leaf and pollen lipidomes under high temperature stress

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High temperature is a major environmental factor that limits wheat productivity. Understanding how wheat (*Triticum aestivum L.*) plants under high day and night temperature (HT) stresses regulate lipid composition, to maintain stable membranes and generate appropriate signals, is critical to developing climate-resilient wheat varieties. We measured glycerolipids and sterol derivatives under optimum temperature and HT in leaves and pollen of two wheat genotypes, Ventnor (heat tolerant) and Karl 92 (heat susceptible) using electrospray ionization-tandem mass spectrometry. In leaves, levels of 18:3-containing triacylglycerols increased threefold/more under HT, consistent with their possible role in sequestering fatty acids during membrane lipid remodeling. Phospholipids containing odd-numbered or oxidized acyl chains accumulated in leaves under HT. Sterol glycosides and 16:0-acylated sterol glycosides were higher under HT than optimum temperature. Ventnor had lower amounts of phospholipids with oxidized acyl chains under HT and higher amounts of sterol glycosides and 16:0-acylated sterol glycosides than Karl 92. Correlation analysis of lipid levels revealed co-occurring lipids in leaves, which are up-or-down-regulated together through time during HT. Current knowledge of lipid metabolism suggests that the lipids co-occur because they are regulated by the same enzyme(s). Pollen lipidome had a distinct composition than that of leaves. Unlike in leaves, 34:3 and 36:6 species dominated the composition of extraplastidic phospholipids in pollen under optimum and HT conditions. The most heat-responsive lipids in pollen were extraplastidic phospholipids, PC, PE, PI, PA, and PS. PC and PE were negatively correlated. Higher PC:PE at HT indicated possible PE-to-PC conversion, lower PE formation, or increased PE degradation, relative to PC. Taken together, the data demonstrate that lipid compositions of wheat leaves and pollen are altered by HT, in which some lipids are particularly responsive to HT, and similar lipid changes contribute to HT adaptation in both leaves and pollen, though their lipidomes had inherently distinct composition.

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