



**Figure S3.** KEGG annotation and enrichment analysis of differential accumulated metabolites (DAMs) under nitrogen deficiency. (A-C) KEGG pathway enrichment for CK vs Nd1/Nd2/Nd3 comparisons. Differential abundance scores (red/blue bars) indicate the ratio of upregulated

( $\log_2FC > 1.0$ ) to downregulated ( $\log_2FC < -1.0$ ) DAMs relative to CK. Symbols adjacent to pathway names denote superclass categories (e.g., ▲ = flavonoid metabolism). In bubble plots: circle size represents the number of enriched DAMs; color gradient (red to purple) reflects significance level ( $-\log_{10}(P)$ , deeper red =  $P < 0.01$ ).