Supplementary material

Leaf green-white variegation is advantageous under N deprivation in Pelargonium × hortorum

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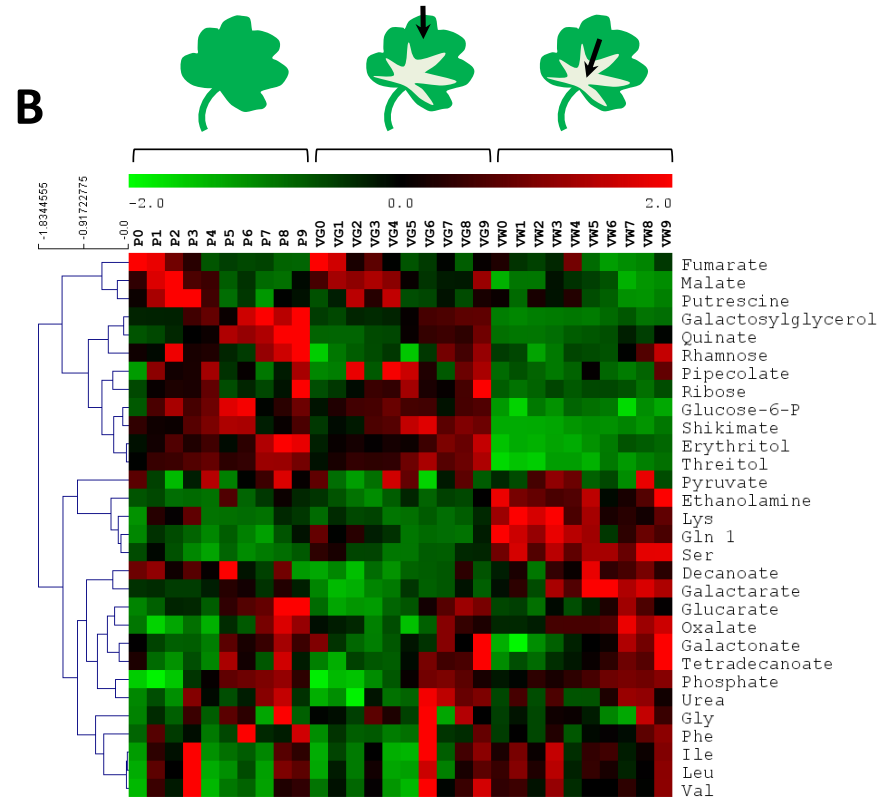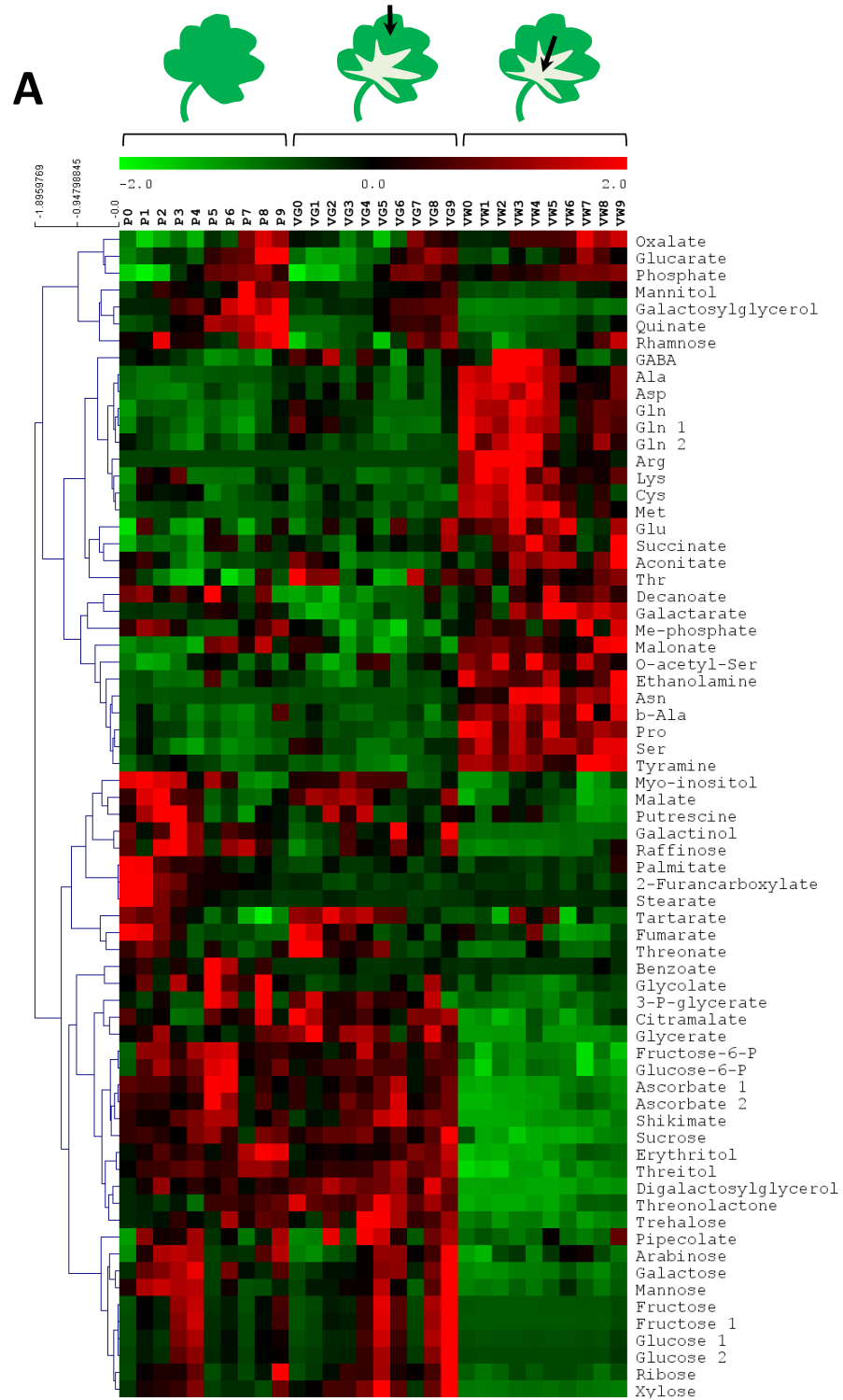
Fig. S1. Heat map representation of metabolomic data, differentiating the effect of leaf tissue (**A**) and that of time (**B**) by a 2-way ANOVA. Metabolites shown are only significant ones ($P<0.05$). Here, sampling times are numbered from 0 (week 0) to 9 (week 9). 63 were differentially abundant in variegated-white/variegated-green/plain tissues (effect of leaf tissue, **A**) and 30 were significantly affected by N-deprivation/time (effect of time, **B**). There is no metabolite in interaction. Plain morphs are indicated by P, green and white tissues of variegated morphs by VG and VW, respectively. Numbers after metabolite names (e.g., Gln 1, Gln 2, etc.) stand for distinct derivatives (analytes) observed by GC-MS. The green-black-red color scale stands for relative (mean-centered) metabolite content (green, low; red, high).

Plain

Variegated green

Variegated white

1
0.8
0
-0.8
-1

Plain
Quinate
Glucarate
Galactosylglycerol
Phosphate
Oxalate
Ala
Erythritol
Threonolactone
Threitol
glycerol-3-P
Trehalose
Malonate
Galactonate
Succinate
Asp
Arg
Urea
Glucose
Asn
Mannitol
Galactarate
Gln
Rhamnose
O-acetyl-Ser
Ethanolamine
Tetradecanoate
Phe
3-P-glycerate
Gly
Ribose
Glycolate
Pyruvate
b-Sitosterol
Citramalate
Glucose-6-P
b-Ala
Glycerol
Lactate
Arabinose
Glu
Sucrose
Glycerate
Gln 1
Pipecolate
Fructose-6-P
Leu
Digalactosylglycerol
Ile
Fructose
Shikimate
Glucose 1
Glucose 2
Fructose 1
Benzoate
Val
Ascorbate 2
Xylose
Gln 2
Thr
Cys
Met
Me-phosphate
Ascorbate 1
Tyramine
Galactose
Ascorbate
Lys
Raffinose
Galactinol
Pro
Decanoate
Ser
Aconitate
GABA
Putrescine
Threonate
Isocitrate
Citrate
Mannose
Malate
2-oxoglutarate
Palmitate
Stearate
2-Furancarboxylate
Fumarate
Myo-inositol
Tartarate

Variegated green
Galactosylglycerol
Quinate
Glucarate
Tetradecanoate
Phosphate
Erythritol
Threitol
Arabinose
Rhamnose
Mannitol
Urea
Galactose
Galactarate
Decanoate
Fructose
Glucose 1
Fructose 1
Shikimate
glycerol-3-P
Glucose 2
Ribose
Raffinose
2-oxoglutarate
Galactinol
Mannose
Glucose
Val
Ile
Glu
Succinate
Xylose
Phe
Glycolate
Glycerol
Leu
Palmitate
Sucrose
Galactonate
Ethanolamine
Asn
Trehalose
Ascorbate 1
Ascorbate 2
Pipecolate
Oxalate
Fructose-6-P
Arg
Glucose-6-P
Tyramine
O-acetyl-Ser
b-Sitosterol
Gly
Digalactosylglycerol
Benzoate
Ascorbate
Pyruvate
Lys
Threonolactone
Ala
Met
Lactate
Putrescine
b-Ala
2-Furancarboxylate
Citramalate
Asp
Me-phosphate
Cys
Glycerate
Thr
Stearate
3-P-glycerate
Malate
Ser
GABA
Pro
Myo-inositol
Gln 2
Aconitate
Isocitrate
Malonate
Citrate
Gln
Gln 1
Fumarate
Threonate
Tartarate

Variegated white
Phosphate
Galactonate
Tetradecanoate
Erythritol
Oxalate
Shikimate
Quinate
Threitol
Threonolactone
Ascorbate 2
Ascorbate 1
Raffinose
Mannitol
Rhamnose
Galactarate
Digalactosylglycerol
Glucarate
Phe
Citramalate
Aconitate
Galactosylglycerol
Fructose 1
Galactose
Citrate
Fructose
Glucose 2
Glucose 1
Ascorbate
Isocitrate
Asn
Glycerol
Arabinose
Mannose
Glucose
Lactate
Decanoate
Palmitate
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Stearate
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Ethanolamine
Myo-inositol
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Val
Xylose
Pyruvate
Glucose-6-P
Tartarate
Ile
Sucrose
Glu
Malate
Trehalose
Leu
Glycerol-3-P
2-Furancarboxylic ac
O-acetyl-Ser
Fructose-6-P
GABA
b-Sitosterol
Pro
Fumarate
Gln 2
Gln
Met
Lys
Putrescine
Cys
Asp
Gln 1
Ala
Arg

Fig. S2. Correlation coefficient ($R = cov(m_i,t)/(s_i s_t)$ where $cov(m_i,t)$ is the covariance between metabolite i and time, and s_i and s_t are the standard deviations of metabolite i and t, respectively) between metabolite content and time in plain and variegated morphs. The horizontal dotted line stands for the threshold of 0.8. Colours indicate R values (scale on the right hand side): green (anticorrelated: decrease with time), white (no correlation at all), and red (positively correlated: increase with time). Note that the present correlation analysis allows one to see monotonic trends in metabolite change over the time course of the experiment; in fact most metabolites showed a monotonic variation with time, with the exception of branched amino acids Ile, Leu and Val (Fig. S1B).

Fig. S3. Relationship between nitrate content in leaves in plain (closed symbols) and variegated (green area, semi-filled symbols; white area, open symbols) morphs under control conditions (*x*-axis) and under N-deprivation (*y*-axis). The continuous line stands for the 1:1 line. Dotted lines define the ±50% region. Data points correspond to the different sampling times (weeks 0 to 9), with each point being the mean of three determinations.

Fig. S4. Magnified version of Fig. 4.