

Züst, T., Rasmann, S. and Agrawal, A. A. 2015.
Growth–defense tradeoffs for two major anti-herbivore traits of the common milkweed *Asclepias syriaca*. – Oikos doi: 10.1111/oik.02075

Appendix 1

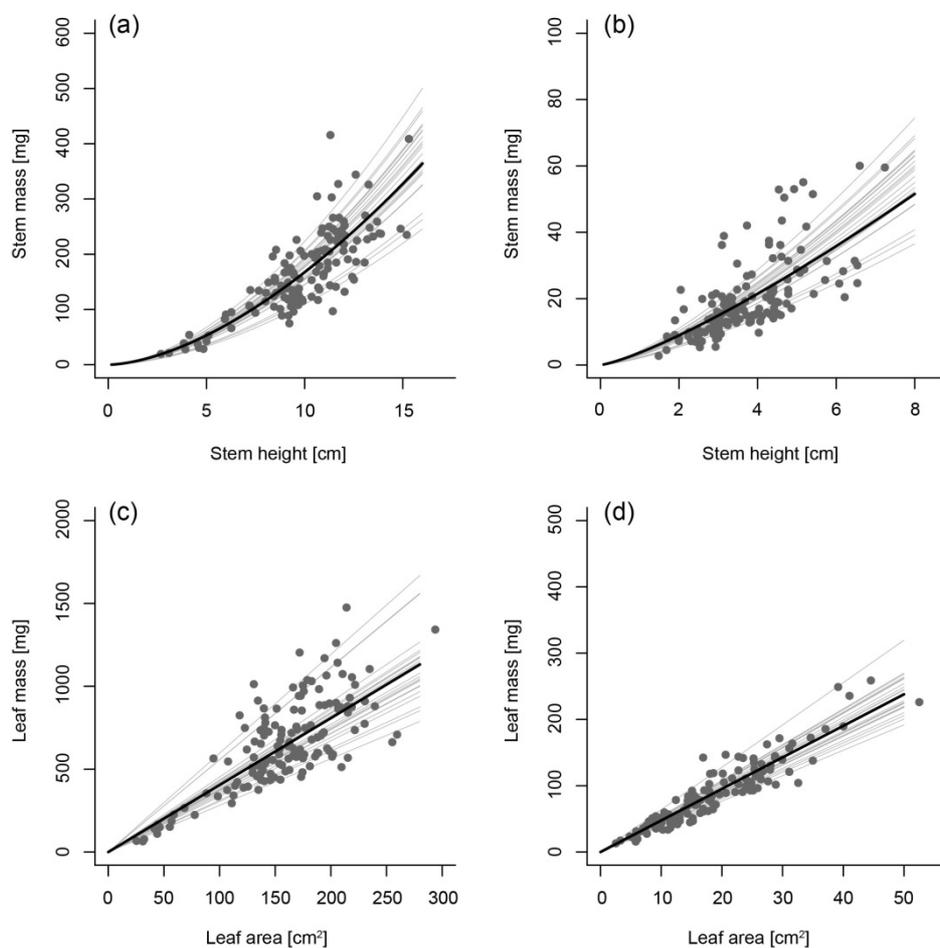


Figure A1. Correlations between measured biomass and non-destructive size measures and model fits used for biomass prediction throughout the experiment. Plants of the high- (a and c) and low-nutrient treatment (b and d) are plotted separately to account for large differences in scale. Each point represents a plant that was measured and destructively harvested either at one of two intermediate or the final harvest. The black lines represent overall model fit for a nutrient level, while grey lines are family-specific fits.

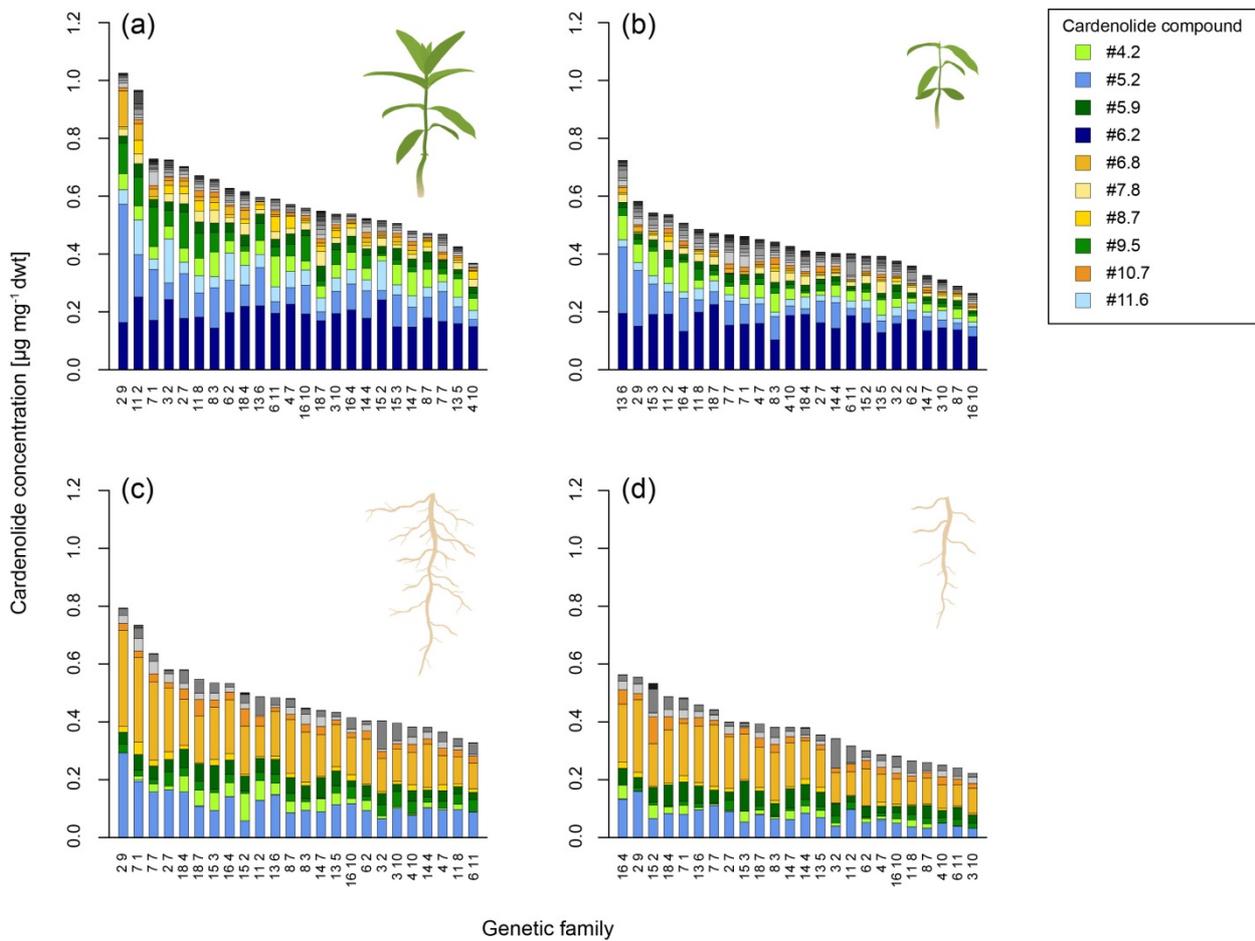


Figure A2. Average cardenolide profiles of the 24 families for shoots in the high (a) and low (b) fertilization treatment, and for roots in the high- (c) and low-nutrient treatment (d). Within each panel, families are ordered from highest to lowest total concentration. The ten most abundant cardenolides are highlighted with color, together representing 89% of the total shoot and 87% of root cardenolide concentration. The numerical identity of each peak indicates HPLC retention time.

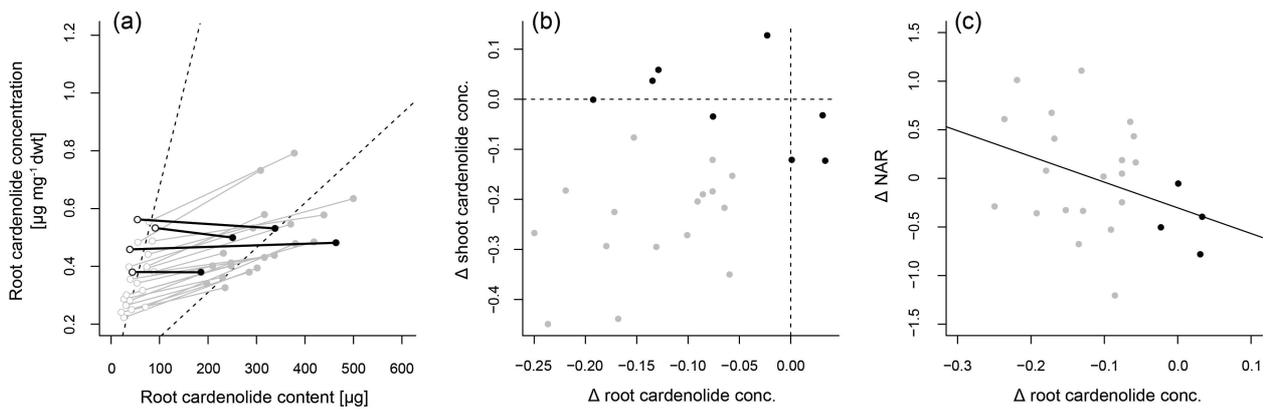


Figure A3. (a) GVA for the effect of nutrient limitation on genetic family means of cardenolide concentration and content (concentration \times dry mass) in roots. Lines link family means in the high- (filled circles) and low-nutrient treatment (empty circles). The majority of plants decreased cardenolide concentration in response to nutrient limitation (grey symbols), while four genetic families showed no change or an increase in concentration (black symbols, arbitrary cut-off at -0.05). Dashed lines represent the mean plant biomass at each nutrient level (given that content = concentration \times biomass). (b) Genetic correlation between the absolute reduction in shoot and root cardenolides in response to nutrient limitation. Negative values correspond to lower trait values in the low-nutrient treatment. (c) Genetic correlation between the absolute change in root cardenolide concentration and change in net assimilation rate for the 24 genetic families in the low- relative to the high-nutrient treatment.

Table A1. Coordinates of the twelve *A. syriaca* populations in Tompkins County, New York and their distance to neighboring populations.

Population	Latitude	Longitude	Distance to nearest neighbor (m)	Average distance to neighbor (m)
Ellis Hollow Creek 1	42.4305833	-76.3872167	128	5076
Ellis Hollow Creek 2	42.4294333	-76.3871	128	5048
Thomas Rd	42.4101333	-76.3800333	1383	5309
Dunlup 1	42.3860167	-76.4005833	431	6057
Dunlup 2	42.38395	-76.3940833	189	6153
Dunlup 3	42.3837167	-76.3963667	189	6158
Bald Hill	42.3580667	-76.3831167	3013	8766
Hunt Hill	42.42235	-76.3768167	1155	5255
Turkey Hill	42.4425833	-76.4290167	3688	6078
Hanshaw Rd	42.49255	-76.4292833	741	8543
Niemi Rd 1	42.5003667	-76.4348167	258	9282
Niemi Rd 2	42.4980667	-76.4343333	258	9054

Table A2. Stepwise simplification of the fixed effects structure for *nlme* models of plant growth using predicted shoot biomass and a logistic function. Models are compared on AIC. The final best model is highlighted in bold.

M_0	K_m	t'	r_m	Model DF	AIC
Nutr \times Fam	Nutr \times Fam	Nutr \times Fam	Nutr \times Fam	210	16922.21
Nutr \times Fam	Nutr \times Fam	Nutr \times Fam	Nutr + Fam	187	16895.64
Nutr + Fam	Nutr \times Fam	Nutr \times Fam	Nutr + Fam	164	16913.98
Nutr + Fam	Nutr + Fam	Nutr \times Fam	Nutr + Fam	141	17083.75
Nutr + Fam	Nutr + Fam	Nutr + Fam	Nutr + Fam	118	17131.58

Table A3. Stepwise simplification of the fixed effects structure for *nlme* models of plant growth using log-leaf area and an asymptotic function. Models are compared on AIC, and simpler models are favored when pairs of nested models are tied within two units of AIC. The final best model is highlighted in bold.

A_0	K_l	r_l	Model DF	AIC
Nutr \times Fam	Nutr \times Fam	Nutr \times Fam	156	-97.59
Nutr \times Fam	Nutr \times Fam	Nutr + Fam	133	-85.01
Nutr + Fam	Nutr \times Fam	Nutr + Fam	110	-95.57
Nutr + Fam	Nutr + Fam	Nutr + Fam	87	-46.25

Table A4. Pearson's product-moment correlation coefficients of genetic family means (n = 24) between mechanistic growth parameters, shoot and root biomass, and defensive traits for plants in the high- (black, top right) and low-nutrient treatment (grey, bottom left). Significant correlations are highlighted in bold.

	RGR	RLGR	NAR	SLA	LMR	Shoot biomass	Root biomass	Shoot:root ratio	Shoot cardenolides	Root cardenolides	Latex exudation
RGR	-	0.53	0.57	-0.77	0.18	0.66	0.50	0.20	-0.37	-0.30	0.39
RLGR	0.84	-	0.80	-0.56	-0.41	0.50	0.33	0.32	-0.32	-0.21	0.20
NAR	0.84	0.92	-	-0.74	-0.51	0.66	0.26	0.49	-0.50	-0.02	0.18
SLA	-0.43	-0.39	-0.59	-	-0.15	-0.67	-0.31	-0.44	0.43	0.35	-0.29
LMR	-0.28	-0.64	-0.61	-0.05	-	-0.15	-0.10	-0.10	0.31	-0.35	-0.08
Shoot biomass	0.85	0.88	0.81	-0.36	-0.37	-	0.50	0.55	-0.53	-0.25	0.34
Root biomass	0.72	0.67	0.52	0.03	-0.25	0.83	-	-0.42	-0.25	-0.23	0.56
Shoot:root ratio	0.44	0.44	0.57	-0.70	-0.14	0.39	-0.15	-	-0.30	-0.07	-0.13
Shoot cardenolides	-0.36	-0.46	-0.51	0.59	0.05	-0.51	-0.34	-0.27	-	0.43	0.11
Root cardenolides	-0.07	-0.07	-0.18	0.37	-0.07	-0.07	-0.05	-0.01	0.48	-	-0.23
Latex exudation	0.16	0.16	0.26	-0.18	-0.24	-0.03	-0.01	0.03	0.11	-0.20	-

Table A5. Principal components (PC) for genetic family means of the ten major cardenolide compounds in shoots tissue of plants in the high-nutrient treatment. Only PCs with Eigenvalues > 1 were considered. All PCs were tested for correlations with the net assimilative rate (NAR) of plants in the same treatment. There was a significant positive correlation between NAR and PC2 (bold).

	PC1	PC2	PC3
Eigenvalue	1.58	1.55	1.41
<i>Loadings</i>			
#6.2	0.393		0.486
#5.2	-0.248	-0.571	
#11.6	0.41		0.433
#4.2			-0.542
#9.5		-0.508	
#5.9	0.398	-0.124	
#7.8	0.421	-0.108	-0.184
#8.7	0.473		-0.229
#6.8	-0.1	-0.561	0.141
#10.7	0.202	-0.239	-0.402
Correlation with NAR	$r = 0.06, p = 0.787$	$r = \mathbf{0.63}, p = \mathbf{0.001}$	$r = 0.09, p = 0.675$

Table A6. Principal components (PC) for genetic family means of the ten major cardenolide compounds in shoots tissue of plants in the low-nutrient treatment. Only PCs with Eigenvalues > 1 were considered. All PCs were tested for correlations with the net assimilative rate (NAR) of plants in the same treatment. There were significant positive correlation between NAR and PC1, as well as NAR and PC4 (bold).

	PC1	PC2	PC3	PC4
Eigenvalue	1.716	1.430	1.240	1.171
<i>Loadings</i>				
#6.2	-0.394	-0.362		0.298
#5.2	-0.287	0.489	-0.235	
#4.2	-0.197	0.438	-0.49	
#11.6	-0.369	-0.452		0.103
#7.8		-0.277	-0.52	-0.159
#5.9	-0.438		0.105	-0.418
#9.5	-0.345		-0.106	-0.417
#12.7	-0.123		-0.293	0.694
#8.1	-0.237	0.383	0.525	0.145
#8.3	-0.447		0.212	0.15
Correlation with NAR	$r = 0.46, p = 0.023$	$r = -0.08, p = 0.697$	$r = 0.09, p = 0.650$	$r = -0.58, p = 0.003$