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Supplementary material for

Contrasting altitudinal trends in leaf anatomy between three dominant species in an alpine meadow

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Table S1. Effects of altitude on leaf anatomy in *Elymus nutans* and *Carex moorcroftii*, for which the traits of lower and upper leaf side are shown separately. UECA: Upper epidermal cell area (in μm^2); UECT: Upper epidermal cell thickness (in μm); LECA: Lower epidermal cell area (in μm^2); LECT: Lower epidermal cell thickness (in μm); UCLT: Upper cuticular layer thickness (in μm); LCLT: Lower cuticular layer thickness (in μm). Different letters for each component indicate statistically different mean values within species (P < 0.05), determined by LSD multiple comparison tests. Each anatomical trait was compared separately.

Altitude (m)	*Elymus. nutans*				*Carex. moorcroftii*					
	UECA	UECT	LECA	LECT	UECA	UECT	UCLT	LECA	LECT	LCLT
3064	252±8^{AB}	16.66±0.56^{BC}	216±14^{C}	15.12±0.48^{C}	1137±111^{A}	33.54±1.19^{A}	3.10±0.24^{C}	334±14^{A}	17.78±0.21^{A}	2.79±0.11^{B}
3180	199±32^{B}	14.00±1.45^{C}	200±20^{C}	14.52±0.89^{C}	851±99^{B}	27.32±1.73^{B}	3.00±0.32^{C}	250±37^{B}	15.41±1.15^{B}	2.67±0.07^{B}
3280	310±36^{A}	18.56±0.96^{AB}	304±37^{AB}	17.83±1.20^{B}	403±56^{C}	20.74±1.20^{C}	3.27±0.20^{AB}	124±21^{C}	9.78±0.49^{C}	2.85±0.19^{B}
3371	317±23^{A}	19.64±0.86^{A}	351±23^{A}	20.53±0.90^{A}	752±57^{B}	25.04±0.69^{B}	4.15±0.25^{A}	171±14^{C}	13.25±0.58^{C}	2.75±0.13^{B}
3489	272±13^{AB}	17.30±0.29^{AB}	231±16^{C}	15.78±0.66^{BC}	503±47^{C}	21.08±0.94^{C}	4.10±0.40^{A}	153±20^{C}	12.25±0.90^{CD}	3.45±0.11^{A}
3600	232±12^{B}	16.08±0.69^{BC}	247±16^{BC}	16.13±0.43^{BC}	508±51^{C}	21.60±1.02^{C}	3.68±0.12^{AB}	113±5^{C}	10.71±0.28^{DE}	3.33±0.10^{A}
3700	253±14^{AB}	17.39±0.79^{AB}	242±10^{BC}	16.15±0.36^{BC}	323±32^{C}	18.17±0.75^{C}	3.70±0.23^{AB}	107±5^{C}	10.56±0.32^{DE}	3.30±0.02^{A}

Table S2. Stepwise multiple regression of leaf anatomy against ecological factors of three species (*Scirpus distigmaticus, Elymus nutans, Carex moorcroftii*). Epidermal cell area (in μm^2); Epidermal cell thickness (in μm); Cuticular layer thickness (in μm); Mesophyll cell area (in μm^2); Xylem transect area (in μm^2); Phloem transect area (in μm^2); STN: Soil total N (g kg^{-1}); STC: Soil total C (g kg^{-1}); AT: Air temperature (℃); AH: Air humidity (%); LI: Light intensity (klux). Significant relationships at a $P < 0.05$ level are indicated in bold. N=7.

Species	Leaf traits	Regression factors	Regression coefficient	R^2	P
Scirpus distigmaticus	ECT	AH	0.123	0.191	**0.048**
	CLT	STN	-0.216	0.197	**0.044**
	XTA	LI	-1.527	0.295	**0.011**
Elymus nutans	CLT	AT	-0.114	0.252	**0.020**
	XTA	STC	-5.311	0.287	**0.012**
	PTA	STN	-101.265	0.358	**0.004**
Carex moorcroftii	ECA	pH	450.708	0.694	**<0.001**
	ECT	pH	9.944	0.736	**<0.001**
	CLT	AT	-0.147	0.629	**<0.001**
	MCA	AH	2.425	0.204	**0.040**

Fig. S1. Pearson correlation between leaf traits of three species (*S. distigmaticus, E. nutans, C. moorcroftii*) in 2012. Significant relationships at a $P < 0.05$ level are shown with the regression line. ECA: Epidermal cell area (in μm^2); ECT: Epidermal cell thickness (in μm); CLT: Cuticular layer thickness (in μm); MCA: Mesophyll cell area (in μm^2); XTA: Xylem transect area (in μm^2); PTA: Phloem transect area (in μm^2).

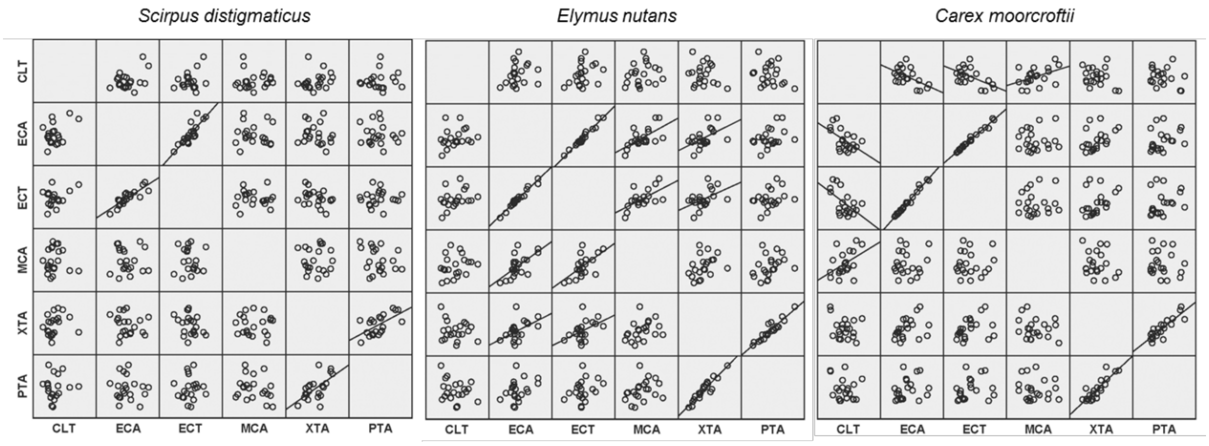

Fig. S2. Leaves (a) and reproductive stems (b) of *Scirpus distigmaticus*. Every little degree represents 1 mm.

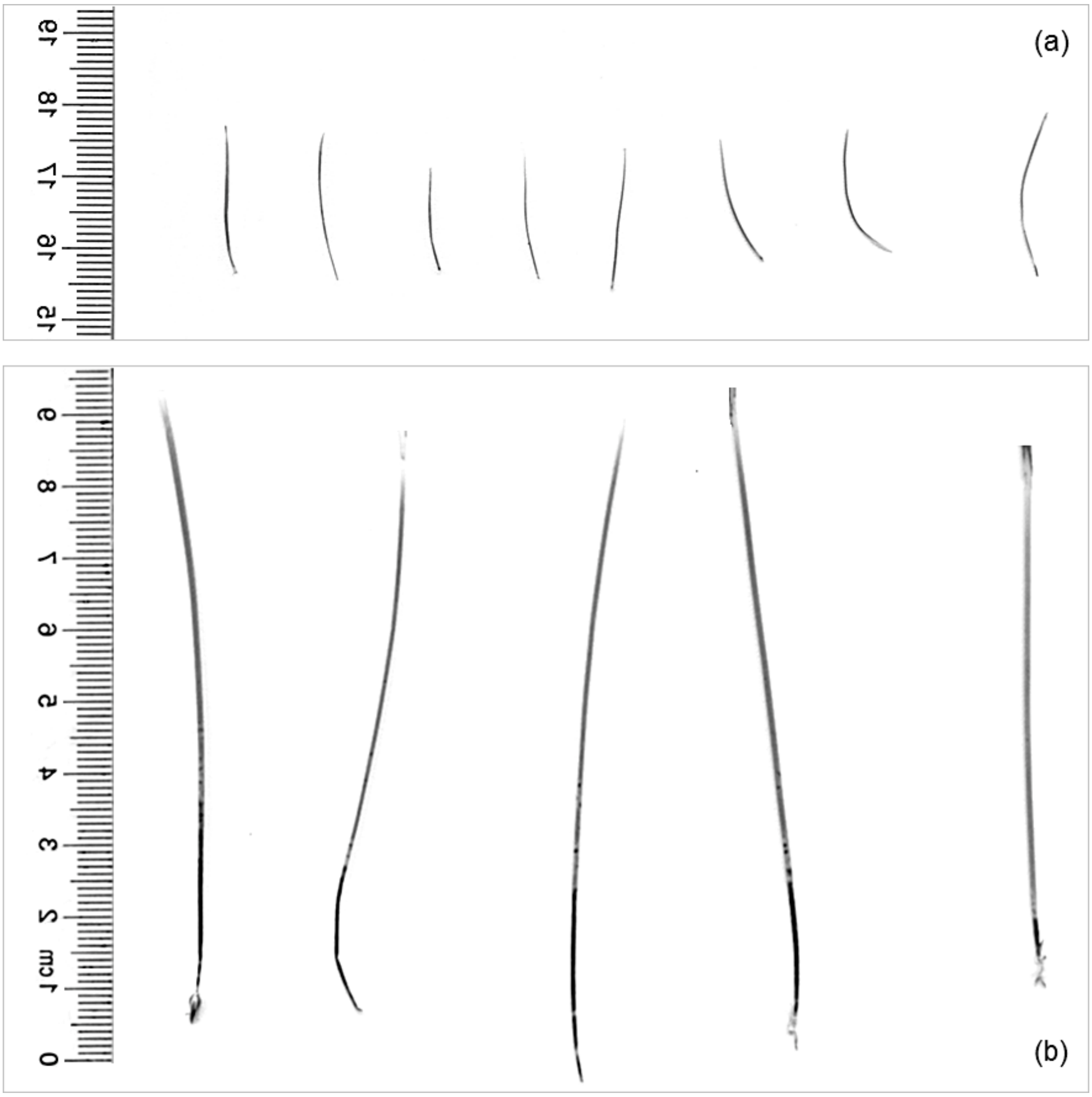

Fig. S3. Anatomy of leaves (a) and reproductive stems (b) taken from *Scirpus distigmaticus* (×100)

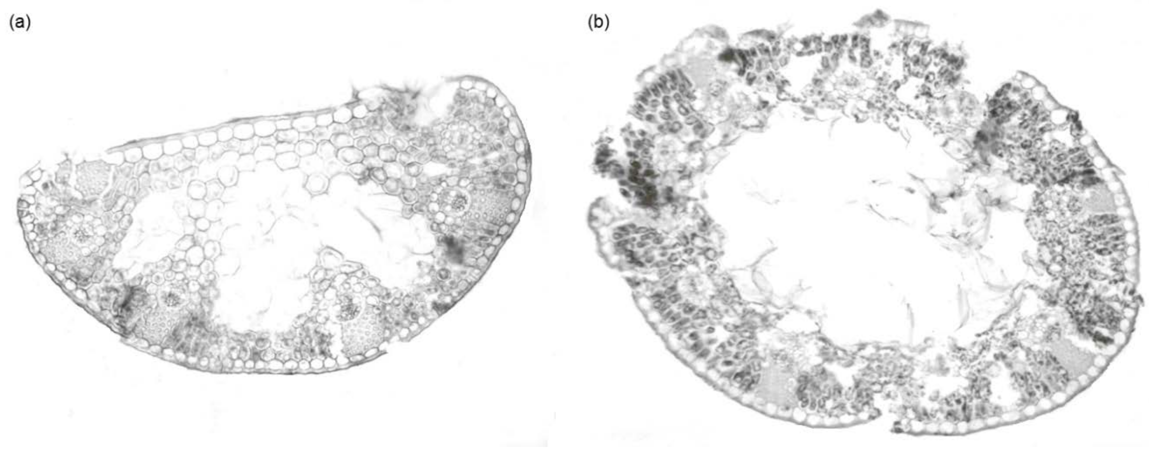

Fig. S4. Structure of leaves (a) and reproductive stems (b) taken from *Scirpus distigmaticus* (×400). 1. Cuticular layer. 2. Epidermal cell. 3. Xylem transect. 4. Phloem transect. 5. Mesophyll cell. 6. Hollow centre.

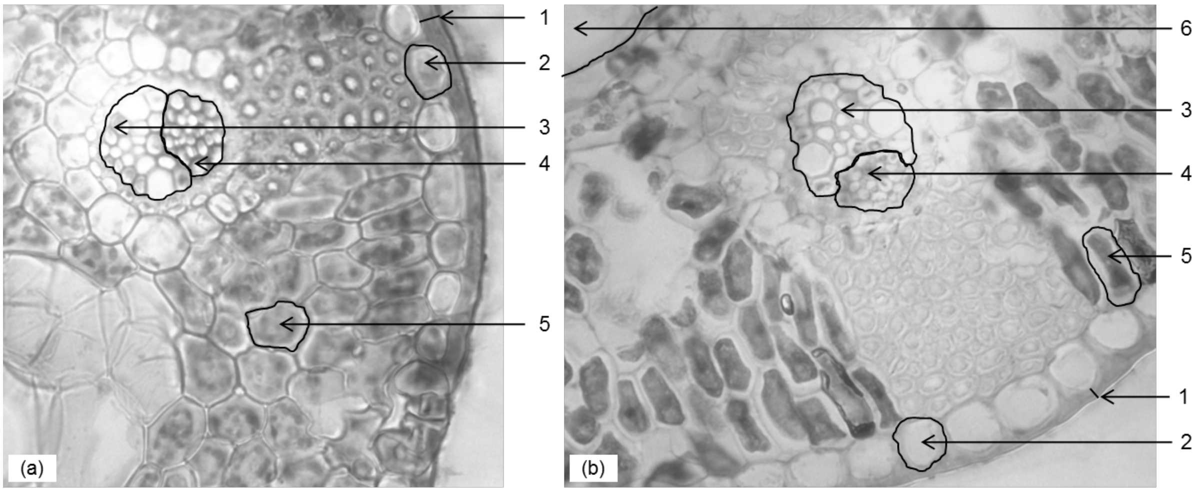

Fig. S5. Response of length and cross-sectional area in leaf and flowering stem of *S. distigmaticus* to altitude. CSA: Cross-sectional area (in μm^2). Different letters above bars for each component indicate statistically different mean values (*P* < 0.05), determined by LSD multiple comparison tests. Leaf or stem was compared separately.

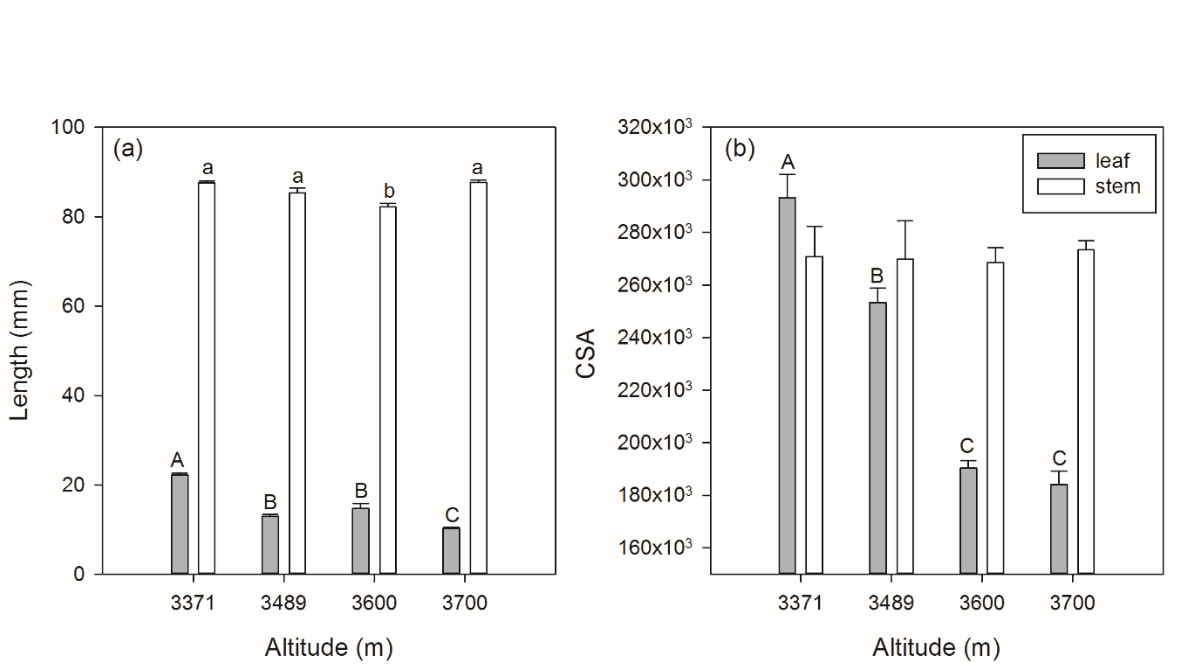

Fig. S6. Regressions of length (mm) and cross sectional area (CSA in μm²) between leaf and stem in *S. distigmaticus* in 2013. Significant relationships at a $P < 0.05$ level are indicated by continuous lines.