Electronic supplementary material

Climbing strategy in herbs does not necessarily lead to lower investments into stem biomass

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Table S1: Collected species of herbaceous climbers, their localities and characteristics. T = twining; S = spines or hooks; E = tendrils. Mean annual precipitation and temperature: Straznice – 627 mm, 9.3°C, Klet – 848 mm, 7.2°C, Trebon – 713 mm, 8.0°C, Edgewater - 1071 mm, 13.3°C

Species	Collection site	GPS coordinates	Date of collection	Number of collected shoots	Climbing mechanism	Perennial/ annual
Bryonia alba L.	Strážnice	48°53'57.9"N, 17°18'56.0"E	18 Sep 2014	4	E	perennial
Fallopia dumetorum (L.) Holub			18 Sep 2014	4	T	annual
Lathyrus pratensis L.	Kleť	48°51'54.9"N, 14°17'01.7"E	21 Jun 2014	3	E	perennial
Calystegia sepium (L.) R. Br.	Třeboň	49°00'16.1"N, 14°46'16.5"E	19 Jun 2011	12	T	perennial
Echinocystis lobata (Michx.) Torr. & A.Gray			22 Sep 2011	7	E	annual
Galium aparine L.			28 Jun 2011	12	S	annual
Humulus lupulus L.			27 Sep 2013	3	T	perennial
Vicia cracca L.			18 Sep 2011	11	E	perennial
Vicia grandiflora Scop.			21 Jun 2014	3	T	annual
Vicia hirsuta (L.) Gray			25 Sep 2011	9	E	annual
Vicia tetrasperma (L.) Schreb.			28 Jun 2011	10	E	annual
Fallopia convolvulus (L.) Á. Löve	Edgewater	38°53'15.0"N, 76°33'14.0"W	4 Sep 2012	4	T	annual
Mikania scandens (L.) Willd.			15 Oct 2012	4	T	perennial
Persicaria perfoliata (L.) H. Gross			7 Sep 2012	4	S	annual
Persicaria sagittata (L.) H. Gross			17 Oct 2012	3	S	annual
Strophostyles helvula (L.) Elliott			17 Sep 2012	4	T	annual

Table S2: List of grassland herbs. Mean annual precipitation and temperature: Straznice – 627 mm, 9.3°C.

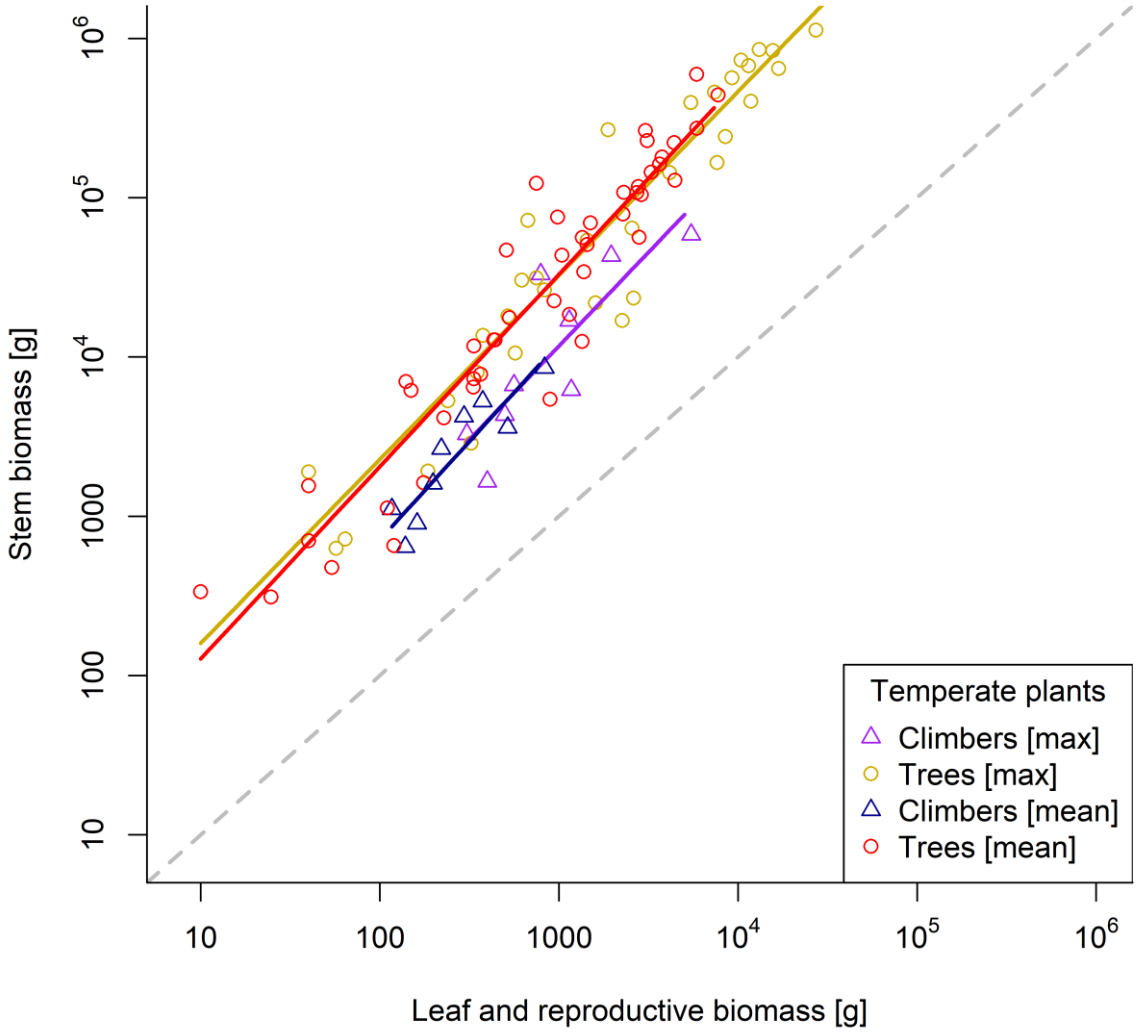
Grassland herbs	
Achillea collina (Becker ex Rchb.f.) Heimerl	*Leontodon hispidus* L.
Asperula cynanchica L.	*Leucanthemum vulgare* (Vaill.) Lam.
Asperula tinctoria L.	*Linum catharticum* L.
Astragalus danicus Retz.	*Melampyrum cristatum* Hablitz ex Steud.
Campanula glomerata L.	*Peucedanum cervaria* (L.) Cusson ex Lapeyr.
Campanula persicifolia L.	*Polygala major* Jacq.
Centaurea jacea L.	*Potentilla alba* L.
Centaurea scabiosa L.	*Potentilla erecta* (L.) Raeusch.
Centaurium erythraea Rafn	*Prunella grandiflora* (L.) Scholler
Chamaecytisus virescens (Kováts ex Neilr.) Dostál	*Pulmonaria angustifolia* L.
Cirsium pannonicum (L.f.) Link	*Ranunculus acris* L.
Clematis recta L.	*Salvia pratensis* L.
Dorycnium pentaphyllum Scop.	*Scorzonera hispanica* L.
Euphorbia cyparissias L.	*Senecio umbrosus* Waldst. & Kit.
Euphorbia esula L.	*Serratula tinctoria* L.
Filipendula vulgaris Moench	*Stachys officinalis* (L.) Trevis.
Galium boreale L.	*Symphytum tuberosum* L.
Galium verum L.	*Tanacetum corymbosum* (L.) Sch.Bip.
Geranium sanguineum L.	*Teucrium chamaedrys* L.
Hypochoeris argentina Cabrera	*Thesium linophyllon* L.
Inula ensifolia L.	*Trifolium montanum* L.
Inula hirta L.	*Trifolium ochroleucon* Huds.
Inula salicina L.	*Trifolium pratense* L.
Knautia kitaibelii (Schult.) Borbás	*Veronica austriaca* L.
Lathyrus niger (L.) Bernh.	*Vincetoxicum hirundinaria* Medik.

Table S3: List of megaherbs from Kamchatka Peninsula and the island of Sakhalin. Data on these species were used in the analysis and taken from Morozov and Belaya (1988).

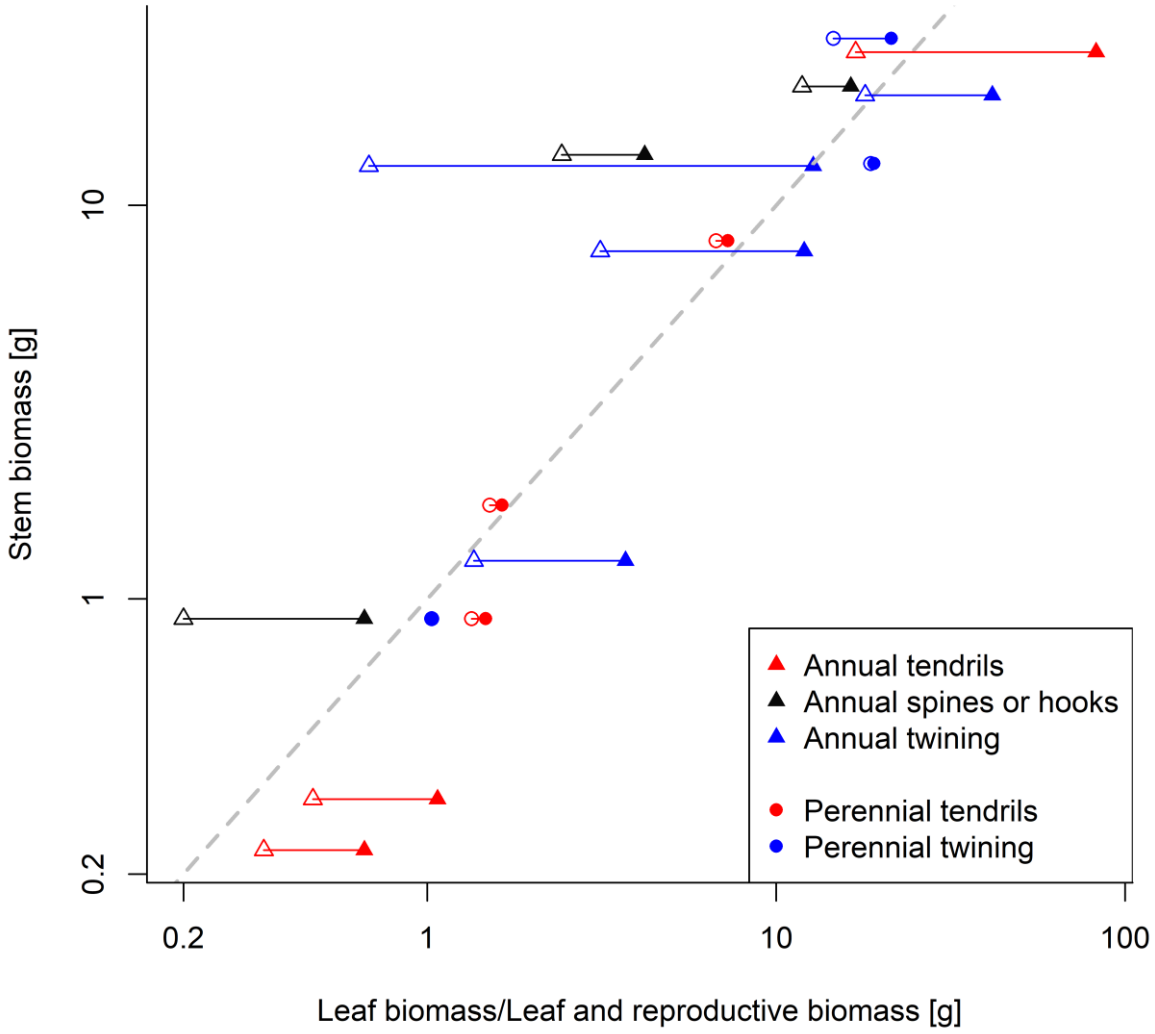
Megaherbs
Aconitum fischeri Rchb.
Aconitum maximum Pall. ex DC.
Angelica genuflexa Nutt.
Angelica sachalinensis Maxim.
Angelica ursina (Rupr.) Maxim.
Anthriscus sylvestris (L.) Hoffm.
Aralia cordata Thunb.
Aruncus dioicus (Walter) Fernald
Parasenecio hastatus (L.) H. Koyama
Parasenecio auriculatus (DC.) J. R. Grant
Cardiocrinum cordatum (Thunb.) Makino
Actaea simplex (DC.) Wormsk. ex Prantl
Cirsium kamtschaticum Ledeb. ex DC.
Cirsium weyrichii Maxim.
Filipendula camschatica f. glabra Koidz.
Filipendula camschatica f. typica Koidz.
Heracleum lanatum Michx.
Ligularia fischeri (Ledeb.) Turcz.
Pleurospermum uralense Hoffm.
Polygonum weyrichii F. Schmidt
Jacobaea cannabifolia (Less.) E.Wiebe
Urtica platyphylla Wedd.
Veratrum grandiflorum (Maxim. ex Miq.) O. Loes.
Veratrum oxysepalum Turcz.

Table S4: Means and standard deviations (SD) of length and biomass measures for climbers and self-supporting herbs. In brackets are species numbers for each growth form. Length of Megaherbs was available only for 6 species.

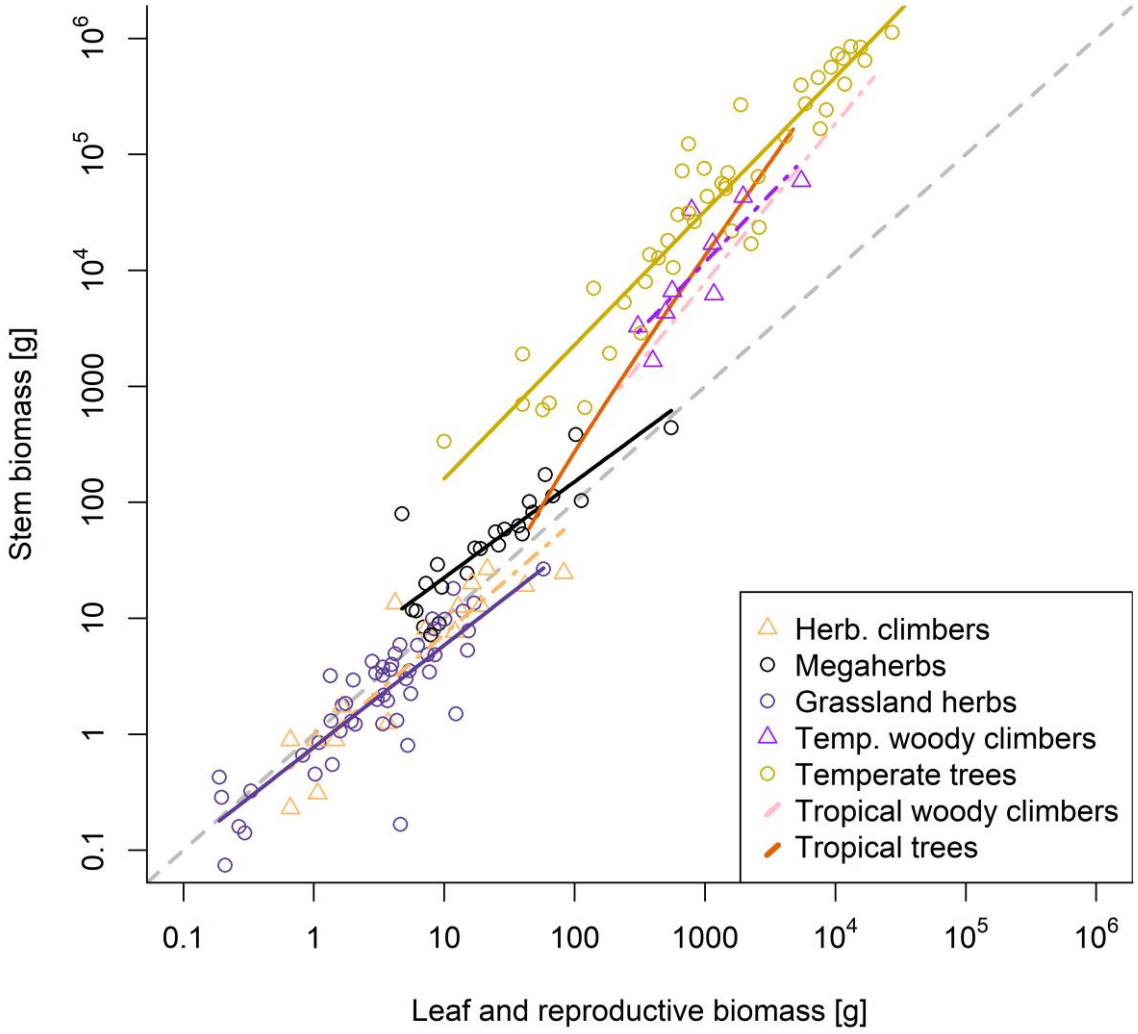
	Annual climbers (10)		Perennial climbers (6)		Megaherbs (24)		Grassland herbs (50)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Length (cm)	302.052	196.801	318.047	217.609	246.667	44.572	39.353	18.608
Biomass of leaves (g)	5.536	7.163	7.312	7.629	52.504	110.014	5.045	8.216
Biomass of stems (g)	9.990	9.222	8.488	10.054	82.029	109.753	4.019	4.950
Biomass of reproductive organs (g)	12.032	20.233	1.335	2.685	-	-	0.801	0.941



Supplementary Figure 1: Relationship of leaf and reproductive biomass (log) and stem biomass (log) for temperate woody climbers and trees. Relationships fitted using linear model are visualized for mean and max values per species showing nearly identical slopes. Data are from Ichihashi and Tateno (2015).



Supplementary Figure 2: Stem, leaf and reproductive biomass of herbaceous climbers. Empty symbols denote leaf biomass; filled symbols denote leaf plus reproductive biomass. The same species with and without reproductive biomass is connected by black line. Grey dotted line marks slope 1.



Supplementary figure 3: Relationship between stem biomass (log) and remaining aboveground biomass (log) of climbers and self-supporting plants. Lines for herbaceous climbers, megaherbs and grassland herbs are modelled using a phylogenetic generalized least squares model. For megaherbs, data on reproductive biomass is not available, thus only stem biomass is included (identical to Fig. 1). In case of temperate woody plants, we visualized fitted lines from linear regression. For tropical woody plants datapoints are not available. Lines for climbers are dash-and dotted. The grey dotted line marks slope 1.

Supplementary information 1

To compare allocation of herbaceous climbers and self-supporting herbs with their woody counterparts we used published equations about tropical woody climbers and trees. These are:

1) $AGB_{climbers}=10^{0.07+2.17*\log(D)}$

2) $AGB_{trees}=0.603*e^{-1.754+2.665*\ln(D)}$

3) $LM_{climbers}=10^{-0.57+0.81*\log(BA)}$

4) $LM_{trees}=10^{-1.26+0.84*\log(BA)}$

where *AGB* stands for aboveground biomass, *D* for stem diameter, *LM* for leaf biomass and *BA* for basal area ($BA=\pi*(D/2)^2$), log being the decimal logarithm and ln being the natural logarithm with base *e*. Equations 1, 3 and 4 are from Gerwing and Fabias (2000); equation 2 is from Higuchi et al. (1998).

From these equations we estimated relationship between leaf and stem biomass (rest of aboveground biomass – reproductive organs included) separately for trees and woody climbers. This was done by simulation of stem diameter values in reported range of 1 to 16 cm. We simulated 1501 of such values and computed leaf and stem biomass from each of them using abovementioned equations. Intercept and slope were estimated using linear model with this computed stem biomass (as response) and leaf biomass (as predictor). Computed leaf and stem biomass values represented a line (explained variability of the linear model: $R^2_{climbers}=1$, $R^2_{trees}=0.9996$).

Resulting relationships (Fig. 2):

5) $\ln(SM_{climbers}) = -0.497 + 1.370 * \ln(LM_{climbers})$

6) $\ln(SM_{trees}) = -1.991 + 1.659 * \ln(LM_{climbers})$

where *SM* stands for stem biomass, *LM* for leaf biomass (plus reproductive organs) and Ln for natural logarithm with base *e*.