

Appendix S1. Species compositions considered

Focal species		neighbouring species							
<i>Dactylis glomerata</i>	<i>Alopecurus pratensis</i>	<i>Arrhenatherum elatius</i>	<i>Phleum pratense</i>	<i>Poa trivialis</i>	<i>Trifolium repens</i>	<i>Trifolium pratense</i>	<i>Geranium pratense</i>	<i>Anthriscus sylvestris</i>	
1	1	0	0	0	0	1	0	0	
1	0	1	0	0	0	0	0	1	
1	0	0	1	1	1	0	0	0	
1	0	0	0	0	0	1	0	0	
1	1	0	0	0	0	1	0	0	
1	0	0	0	0	0	0	0	1	
1	1	1	1	1	1	1	1	1	
1	0	1	0	1	0	1	0	0	
1	1	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	1	0	
1	0	1	0	0	0	0	0	0	
1	1	0	0	0	0	0	0	1	
1	0	1	0	0	0	1	0	0	
1	0	0	0	0	1	0	0	0	
1	0	0	0	1	0	0	0	0	
1	0	0	1	1	1	0	0	1	
1	0	0	0	0	0	0	0	0	
1	0	1	1	0	1	1	0	1	
1	0	0	1	0	0	0	0	1	
1	0	0	1	0	1	0	1	0	
1	0	0	0	0	0	0	0	1	
1	1	1	1	0	0	0	0	0	
1	0	0	0	0	0	1	0	0	

Appendix S2. Quantifying phylogenetic distances

Phylogenetic distances were inferred from a dated and finely resolved phylogeny covering a total of 557 genera. Details of analyses on reconstruction of a dated phylogeny of genera of Dutch angiosperms are provided in Hermant et al (Hermant *et al.* 2012, their Appendix E). A dated tree in Newick format with all these genera represented is available from the TreeBase ID: S13572. The tree is highly congruent with, but often more resolved than that of Durka & Michalski (2012) for the larger region of Europe. The tree is also congruent with that of Zanne *et al.* (2014). Zanne *et al.*'s tree covers some 10-15% of the global Angiosperm flora, which renders it inevitably less complete and representative of lineages in our experiment than the complete tree we used. We note that estimation of age of the crown node of Angiospermae from dating molecular phylogenies is still an issue of considerable uncertainty (Bell *et al.* 2010; Smith *et al.* 2010; Magallon *et al.* 2013). However, the congruence among several dated molecular reconstructions of the earliest evolution in Eudicotyledoneae and paleobotanic records (Doyle & Hotton 1991) suggest that this age estimate provides a robust constraint for calibrating phylogenies in this large taxon (see also Magallon *et al.* 2013). We therefore used this estimate as a fixed age constraint for the crown node of Eudicotyledoneae in our dating analyses of Dutch angiosperms. Hermant et al. (Appendix E) provide details on other node calibrations.

References

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- Zanne, A.E., Tank, D.C., Cornwell, W.K., Eastman, J.M., Smith, S.A., FitzJohn, R.G. *et al.* (2014). Three keys to the radiation of angiosperms into freezing environments. *Nature*, 506, 89-92.

Appendix S3. Full set of analyses conducted, including such without accounting for covariables

Table S1. Means of total amines, individual amines and C/N ratios as a function of the source neighbourhood. Models include only diversity and distinctness of the neighbourhood/ diversity and distinctness of the neighbourhood, and biomass ratios as covariable (indicating the resource conditions in the source neighbourhood)/ diversity and distinctness of the neighbourhood, and biomass ratios and the presence and absence of neighbour species exerting a significant effect on the corresponding dependent variable (where such an effect exists). Variable excluded by model selection: “.”, variables included but at $P > 0.1$: “ns”, variables included at $P < 0.1, 0.05, 0.01, 0.001$: (+), +, ++, +++ or (-), -, --, ---. NA = not applicable (e.g. biomass ratios for a model not containing biomass ratio or models with species exerting significant univariate effects where no such species exist).

	effect of diversity and distinctness of source neighbourhood (per se / incl. biomass ratio / incl. biomass ratio and sign. species)					biomass ratio of <i>Dactylis glomerata</i> in source neighbourhood	species in source neighbourhood exerting a significant univariate effect	df	R ²
	phylogenetic distance	number of Poaceae species	number of leguminous species	total species number	number of functional groups				
total amines	ns / ns / NA	ns / ns / NA	- / - / NA	+ / + / NA	- / - / NA	NA / . / NA		18/18/NA	0.34/0.34/ NA
Agmatine	. / . / .	- / -- / --	-- / --- / --	++/+++ / ++	(-) / - / -	NA / + / +	+ <i>Anthriscus sylvestris</i>	20/19/18	0.55/0.66/68
N-acetylputrescine	ns / ns / NA	(-) / (-) / NA	- / - / NA	+ / + / NA	- / - / NA	NA / . / NA		17/17/NA	0.46/0.46/ NA
Putrescine	. / . / NA	. / ns / NA	. / + / NA	. / . / NA	ns / . / NA	NA / - / NA		23/21/NA	0.06/0.27/NA
Spermidine	ns / . / .	. / . / .	ns / . / (+)	. / . / .	. / . / .	NA / (-) / (-)	+ <i>Poa trivialis</i>	20/21/21	0.07/0.13/0.38
Spermine	. / . / .	. / . / .	+ / + / +	. / . / .	. / . / .	NA / . / .	+ <i>Poa trivialis</i>	23/23/22	0.16/0.16/0.32
N¹-acetylspermine	. / . / ns	ns / ns / .	+ / + / .	(-) / (-) / .	. / . / .	NA / + / .	- <i>Phleum pratense</i> /+ <i>Poa trivialis</i>	19/19/20	0.26/0.26/0.48
1,3-diaminopropane	ns / ns / NA	. / ns / NA	. / ns / NA	(-) / . / NA	. / ns / NA	NA / + / NA		21/18/NA	0.16/0.36/NA
Cadaverine	. / . / NA	. / . / NA	ns / ns / NA	. / . / NA	. / . / NA	NA / . / NA		23/23/NA	0.04/0.04/NA
Phenylethylamine	(+) / ns / NA	. / . / NA	. / ns / NA	+ / (+) / NA	(-) / (-) / NA	NA / ns / NA		19/17/NA	0.26/0.36/NA
Tyramine	- / - / NA	- / - / NA	. / . / NA	. / . / NA	. / . / NA	NA / . / NA		22/22/NA	0.31/0.31/NA
Octopamine	. / . / .	(+) / (+) / ---	. / . / ---	-- / -- / +++	. / . / --	NA / . / .	+ <i>Alopecurus pratensis</i> / - <i>Phleum pratense</i> /+ <i>Poa trivialis</i>	20/20/17	0.30/0.30/0.86
Dopamine	(+) / (+) / NA	. / . / NA	ns / ns / NA	ns / ns / NA	ns / ns / NA	NA / . / NA		18/18/NA	0.20/0.20/NA
3-methoxy-4-hydroxy-phenylethylamine	. / . / NA	. / . / NA	. / . / NA	. / . / NA	ns / ns / NA	NA / . / NA		23/23/NA	0.05/0.05/NA
Tryptamine	ns / . / NA	. / . / NA	. / ns / NA	. / . / NA	. / . / NA	NA / (-) / NA		23/22/NA	0.07/0.16/NA
Serotonin	(-) / (-) / NA	. / . / NA	. / . / NA	. / (+) / NA	ns / . / NA	NA / ns / NA		21/20/NA	0.16/0.24/NA
C/N	. / . / ns	. / . / .	. / . / .	- / - / -	ns / ns / ns	NA / . / .	- <i>Poa trivialis</i>	22/22/20	0.24/0.24/0.32

Table S2. Variances of total amines, individual amines and C/N ratios as a function of the source neighbourhood. Models include only diversity and distinctness of the neighbourhood / diversity and distinctness of the neighbourhood, and biomass ratios as covariable (indicating the resource conditions in the source neighbourhood) / diversity and distinctness of the neighbourhood, and biomass ratios and the presence and absence of neighbour species exerting a significant effect on the corresponding dependent variable (where such an effect exists). Mean levels are always included to account for possible increase of variance with means. Variable excluded by model selection: “.”, variables included but at $P > 0.1$: “ns”, variables included at $P < 0.1, 0.05, 0.01, 0.001$: (+), +, ++, +++ or (-), -, --, ---. NA = not applicable (e.g. biomass ratios for a model not containing biomass ratio or models with species exerting significant univariate effects where no such species exist)

	effect of diversity and distinctness of source neighbourhood (per se / incl. biomass r'o /incl. biomass r'o and sign. neigh'g spec)					mean	biomass ratio of <i>Dactylis</i> in source neighbourhood	species in source neighbourhood exerting a significant univariate effect	Df	R ²
	phylogenetic distance	number of Poaceae species	number of leguminous species	total species number	number of functional groups					
total amines	. / . / NA	. / . / NA	. / . / NA	. / . / NA	- / (-) / NA	+++ / +++ / NA	NA / ns / NA		22/20/NA	0.79/0.69/NA
Agmatine	. / . / .	. / . / .	- / - / -	. / . / .	. / . / .	+ / + / .	NA / . / .	+ <i>Geranium pratense</i> + <i>Anthriscus sylvestris</i>	20/20/18	0.52/0.52/0.59
Putrescine	. / . / NA	. / . / NA	ns / ns / NA	. / . / NA	. / . / NA	. / . / NA	NA / . / NA		23/23/NA	0.05/0.05/NA
Spermidine	. / . / .	. / . / .	- / - / ns	ns / ns / .	. / . / .	. / . / .	NA / . / ns	+ <i>Phleum pratense</i>	22/22/21	0.18/0.18/0.37
Spermine	. / . / .	. / ns / ns	. / ns / (-)	ns / (+) / (+)	(-) / (-) / (-)	ns / (+) / +	NA / ns / (+)	+ <i>Poa trivialis</i>	21/18/17	0.21/0.34/45
N¹-acetylspermine	. / . / .	. / . / (+)	. / . / ns	. / . / .	. / . / .	+++ / +++ / +++	NA / . / .	+ <i>Poa trivialis</i>	22/22/19	0.63/0.63/0.72
1,3-diaminopropane	. / . / .	. / . / .	. / . / .	(-) / (-) / (-)	. / . / .	+++ / +++ / +++	NA / . / .	+ <i>Poa trivialis</i>	21/21/21	0.57/0.57/57
Cadaverine	(+) / + / NA	. / . / NA	. / . / NA	+ / (+) / NA	-- / -- / NA	+++ / +++ / NA	NA / ns / NA		20/19/NA	0.53/0.61/NA
Phenylethylamine ?	. / . / NA	-- / -- / NA	. / . / NA	++ / ++ / NA	-- / -- / NA	+++ / +++ / NA	NA / ns / NA		19/18/NA	0.95/0.95/NA
Tyramine	. / . / NA	ns/ns/NA	. / . / NA	. / . / NA	. / . / NA	+++ / +++ / NA	NA / . / NA		21/21/NA	0.57/0.57/NA
Octopamine	+ / + / +	+ / ++ / .	. / . / ns	. / . / +	ns/ns/ns	+++ / +++ / +++	NA / (-) / .	+ <i>Alopecurus pratensis</i> /+ <i>Geranium pratense</i> /+ <i>Anthriscus sylvestris</i>	20/19/18	0.90/0.91/92
Dopamine	. / . / NA	. / . / NA	ns / ns / NA	++ / ++ / NA	-- / -- / NA	+++ / +++ / NA	NA / . / NA		19/19/NA	0.94/0.97/NA
3-methoxy-4-hydroxy phenylethylamine	. / . / NA	. / . / NA	. / . / NA	. / . / NA	. / . / NA	+++ / +++ / NA	NA / . / NA		23/23/NA	0.44/0.44/NA
Tryptamine	. / . / NA	ns / . / NA	. / . / NA	. / . / NA	. / . / NA	+++ / +++ / NA	NA / . / NA		21/21/NA	0.73/0.73/NA
Serotonin	. / . / NA	. / . / NA	. / . / NA	. / . / NA	. / . / NA	+++ / +++ / NA	NA / . / NA		22/22/NA	0.56/0.56/NA
C/N	++ / ++ / NA	++ / ++ / NA	ns / ns / NA	. / . / NA	- / - / NA	(+) / (+) / NA	NA / . / NA		19/19/NA	0.52/0.52/NA

