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This is an electronic appendix to the paper by Davies *et al*. 2004 Environmental energy and evolutionary rates in flowering plants. *Proc. R. Soc. Lond.* B **271**, 2195–2200. (doi:10.1098/ rspb.2004.2849)

Electronic appendices are refereed with the text. However, no attempt is made to impose a uniform editorial style on the electronic appendices.

Electronic Appendix A

Environmental measures

UV exposure was gathered from average monthly data sets between 1978 and 1993 determined from daily measurements at a resolution of 1º latitude by1.25º longitude by the total ozone mapping spectrometer, aboard the Nimbus 7 satellite (NASA/GSFC TOMS Team, available from http://jwocky.gsfc.nasa.gov). Units are in terms of erythemal exposure and can be regarded as an index of the potential for biological damage due to solar irradiation. Due to the nature of the orbit of the satellite, no data were available for latitudes above 65º, and we therefore used a model of global UV exposure (Forster 1995) to extrapolate the satellite data to cover the latitudes between 65º and 90º. The close agreement between the data sets (r^2 = 0.99) for those latitudes represented in both estimates between 0º and 65º indicates that this approach offers a good approximation. Surface air temperature was obtained from the online Global Ecosystem Database (available from http://www.ngdc.noaa.gov/seg/eco/cdroms/gedii_a/datasets/a03/lc.htm), representing characteristic average monthly surface air temperatures from 1931 to 1960. The data are measured in units of 0.1ºC at a resolution of 0.5º by 0.5º. Actual evapotranspiration (AET) data were obtained from the Global Resource Information Database of the United Nations Environment Programme and comprised characteristic monthly readings from 1920 to 1980, measured in millimetres at a resolution of 0.5º by 0.5º (available from http://www.grid.unep.ch/data/grid

/gnv183.php). Two additional variables, elevation and latitude, were included as possible surrogates for alternative environmental parameters. A digital elevation model on a 30 arc-second latitude/longitude grid was obtained from the U.S. Geological Survey's EROS Data Center (GTOPO-30, available from http://edcdaac.usgs.gov/gtopo30/gtopo30.html). Latitude was specified at a resolution of 0.25º by 0.25º with each cell representing the mean degrees from the equator of the area it represented.

Forster, P. M. de F. Modelling ultraviolet radiation at the Earth's surface. Part I: The sensitivity of ultraviolet irradiances to atmospheric changes *J. Appl. Meteorol.* **34**, 2412 (1995).

Model Criticism

Model criticism was performed on all minimum adequate models to check for non-constancy of variance and non-normality of errors (Crawley 2002). All models conformed to model assumptions for the contrasts assigned high weight. Alternative transformations of area (log and square root) and the species richness contrasts (uncorrected for node age), and exclusion of contrasts with high leverage did change the details of which energy terms remained in the models. However, general conclusions are robust to all treatments: species richness correlates strongly with environmental energy; all measures of energy perform almost equally well as predictors of species richness; molecular rates either fall out of the model or remain as a weak term when included in the starting model. We favour the versions presented in the paper and tables 2 and 3 because they best conform to the assumption of constant variance. The nuclear ribosomal gene, 18S rDNA, was retained as a significant negative predictor of species richness within all the models in which it was included amongst the starting parameters. The direction of influence is contrary to the predictions of the faster evolution theory, suggesting that taxa with slower rates of change in18S have more species. However, retention of the 18S rDNA partition was not robust to the sensitivity analyses.

Table 2. *Multiple regressions between species richness, molecular rates, and various combinations of explanatory variables allowing pair-wise interactions among variables.*

(Energy = both direct and indirect measures of environmental energy, SR = species richness, MR = molecular substitution rate estimated from third position sites of the protein coding genes, Temp = temperature, Lat = latitude, UV = Ultraviolet radiation, AET = actual evapotranspiration. All models are significant with $P<0.001$. As interaction terms may cancel out main effects, only significant non-nested terms are listed. Due to the large number of explanatory variables for models including interaction terms, after following the model simplification described in the Materials and Methods, we removed additional terms until further simplification led to an increase in deviance of more than 5% [M. Crawley, pers. comm.].)

Response Variable	Explanatory Variable	r^2	coefficients	r^2	t	P
SR	Energy	0.63	Temp	0.19	6.55	<0.001
			Area	0.54	11.14	<0.001
SR	Energy + MR	0.63	AET	0.05	2.30	0.024
			UV	0.05	3.28	0.002
			Area	0.59	11.60	<0.001
MR	Energy	0.41	AET:UV	0.19	5.37	<0.001
			AET:Area	0.11	4.10	<0.001
			Lat:UV	0.14	4.62	<0.001
			Lat:Area	0.08	3.46	<0.001
			UV:Area	0.06	2.91	0.005

Table 3. *Multiple regressions between molecular rates and various combinations of explanatory variables, excluding each direct measure of energy in turn*.

(Molecular rates estimated from third position sites of the protein coding genes, Energy = both direct and indirect measures of environmental energy, Temp = temperature, Lat = latitude, UV = Ultraviolet radiation, AET = actual evapotranspiration, Elev = elevation. All models are significant with P<0.001. Only significant non-nested terms are listed in the tables. Model simplification as described for Table 2.)

Explanatory Variable	r^2	Coefficients	r^2	t	*P*
Energy excluding AET	0.35	Elev:Lat	0.14	4.37	<0.001
		Elev:UV	0.13	4.09	<0.001
		Temp:Area	0.06	-2.92	0.005
		UV:Area	0.06	2.88	0.005
Energy excluding Temp	0.41	AET:UV	0.19	5.37	<0.001
		AET:Area	0.11	4.10	<0.001
		Lat:UV	0.14	4.62	<0.001
		Lat:Area	0.08	3.46	<0.001
		UV:Area	0.06	2.91	0.005
Energy excluding UV	0.19	Lat	0.19	-4.52	<0.001
		Area	0.05	2.40	0.019

Table 4. *Multiple regressions between species richness, molecular rates, and various combinations of explanatory variables.*

(Energy = both direct and indirect measures of environmental energy, SR = species richness, 18S = nuclear ribosomal gene (18S rDNA), 2nd = second position sites of the plastid protein coding genes, Total MR = all genes and all sites combined, AET = actual evapotranspiration, Temp = temperature, Elev = elevation, Lat = latitude. All models are significant with P<0.001.)

Response Variable	Explanatory Variable	r^2	coefficients	r^2	t	*P*
SR	Total MR + Energy	0.63	Temp	0.19	6.55	<0.001
			Area	0.54	11.14	<0.001
SR	2nd + Energy	0.63	Temp	0.19	6.55	<0.001
			Area	0.54	11.14	<0.001
SR	18S rDNA+ Energy	0.66	18S	0.03	-2.94	0.004
			Temp	0.21	7.32	<0.001
			Area	0.55	11.73	<0.001
Total MR	Energy	0.32	Lat	0.03	-2.02	0.047
			UV	0.04	2.35	0.022
			Temp	0.06	-2.85	0.006
			Elev	0.04	-2.35	0.022
			Area	0.05	2.49	0.015
2nd	Energy	0.20	Lat	NA	-4.76	NA
18S	Energy	0.12	AET	0.11	-2.72	0.008
			Lat	0.14	-3.66	<0.001