***New Phytologist* Supporting Information Data S5**

Article title: Angiosperm flowers reached their highest morphological diversity early in their evolutionary history

Authors: Andrea M. López-Martínez, Maria von Balthazar, Jürg Schönenberger, Susana Magallón, Hervé Sauquet, Marion Chartier

Article acceptance date: 20 October 2023

Content: Ancestral state reconstructions for each character obtained with a stochastic mapping approach.

Stochastic character mapping
201_B. Number of perianth parts (D2c)
ER model, fixed tree, 500 sim

one to five
six to ten
more than ten

Node	State	Prob
Angiospermae	six to ten	0.886
Mesangiospermae	six to ten	1
Magnoliidae	six to ten	1
Monocotyledoneae	six to ten	1
Eudicotyledoneae	six to ten	0.994
Commelinidae	six to ten	1
Pentapetalae	six to ten	1
Superasteridae	six to ten	1
Asteridae	six to ten	1
Lamiidae	six to ten	1
Campanulidae	six to ten	1
Superrosidae	six to ten	1
Rosidae	six to ten	1
Malvidae	six to ten	1
Fabidae	six to ten	1

Stochastic character mapping
100_B: Structural sex of flowers (O'zel)
ER model, fixed tree, 500 sim

Stochastic character mapping
102_B. Ovary position (binary) (D2d)
ER model, fixed tree, 500 sim

- superior
- inferior

Node	State	Prob
Angiospermae	superior	0.996
Mesangiospermae	superior	1
Magnoliidae	superior	1
Monocotyledoneae	superior	1
Eudicotyledoneae	superior	1
Commelinidae	superior	0.996
Pentapetalae	superior	1
Superasteridae	superior	1
Asteridae	superior	1
Lamiidae	superior	1
Campanulidae	superior	0.894
Superrosidae	superior	1
Rosidae	superior	1
Malvidae	superior	1
Fabidae	superior	1


Stochastic character mapping
201_A. Perianth presence (D2c)
ER model, fixed tree, 500 sim
absent
present
Node State Prob
Angiospermae present 1
Mesangiospermae present 1
Magnoliidae present 1
Monocotyledoneae present 1
Eudicotyledoneae present 1
Commelinidae present 1
Pentapetalae present 1
Superasteridae present 1
Asteridae present 1
Lamiidae present 1
Campanulidae present 1
Superrosidae present 1
Rosidae present 1
Malvidae present 1
Fabidae present 1

Stochastic character mapping
204_A. Fusion of perianth (D2c)
ER model, fixed tree, 500 sim

free
fused

Node	State	Prob
Angiospermae	free	0.988
Mesangiospermae	free	1
Magnoliidae	free	1
Monocotyledoneae	free	1
Eudicotyledoneae	free	1
Commelinidae	free	0.998
Pentapetalae	free	1
Superasteridae	free	0.974
Asteridae	free	0.836
Lamiidae	fused	0.992
Campanulidae	fused	0.99
Superrosidae	free	1
Rosidae	free	1
Malvidae	free	1
Fabidae	free	1

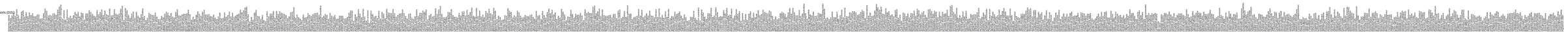
Stochastic character mapping
207_A: Symmetry of perianth (D2d)
ER model, fixed tree, 500 sim

Stochastic character mapping
230_A. Perianth phyllotaxy (D2d)
ER model, fixed tree, 500 sim

whorled
spiral

Node	State	Prob
Angiospermae	whorled	0.85
Mesangiospermae	whorled	1
Magnoliidae	whorled	1
Monocotyledoneae	whorled	1
Eudicotyledoneae	whorled	1
Commelinidae	whorled	1
Pentapetalae	whorled	1
Superasteridae	whorled	1
Asteridae	whorled	1
Lamiidae	whorled	1
Campanulidae	whorled	1
Superrosidae	whorled	1
Rosidae	whorled	1
Malvidae	whorled	1
Fabidae	whorled	1

Stochastic character mapping
231_A. Number of perianth whorls (Ordered)
ER model, fixed tree, 500 sim




Stochastic character mapping
232_A. Perianth merism (D2c)
ER model, fixed tree, 500 sim
dimerous
trimerous
tetramerous
pentamerous
Node State Prob
Angiospermae trimerous 0.986
Mesangiospermae trimerous 0.994
Magnoliidae trimerous 1
Monocotyledoneae trimerous 1
Eudicotyledoneae trimerous 0.806
Commelinidae trimerous 1
Pentapetalae pentamerous 0.99
Superasteridae pentamerous 1
Asteridae pentamerous 1
Lamiidae pentamerous 1
Campanulidae pentamerous 1
Superrosidae pentamerous 1
Rosidae pentamerous 1
Malvidae pentamerous 1
Fabidae pentamerous 1
Magnoliidae

Stochastic character mapping
234_B. Perianth differentiation (D2d)
ER model, fixed tree, 500 sim

- undifferentiated
- differentiated

Node	State	Prob
Angiospermae	differentiated	0.946
Mesangiospermae	differentiated	1
Magnoliidae	differentiated	0.998
Monocotyledoneae	differentiated	0.772
Eudicotyledoneae	differentiated	1
Commelinidae	differentiated	0.956
Pentapetalae	differentiated	1
Superasteridae	differentiated	1
Asteridae	differentiated	1
Lamiidae	differentiated	1
Campanulidae	differentiated	1
Superrosidae	differentiated	1
Rosidae	differentiated	1
Malvidae	differentiated	1
Fabidae	differentiated	1

Stochastic character mapping
301_B. Number of fertile stamens (D2c)
ER model, fixed tree, 500 sim

- one to five
- six to ten
- more than ten

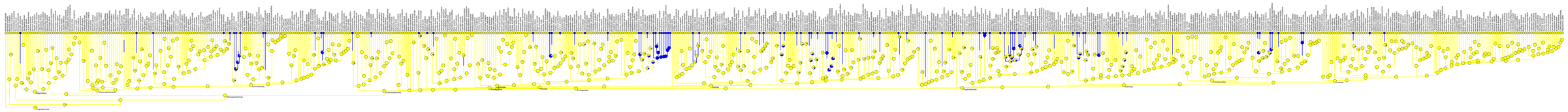
Node	State	Prob
Angiospermae	more than ten	0.766
Mesangiospermae	more than ten	0.598
Magnoliidae	more than ten	0.732
Monocotyledoneae	six to ten	0.916
Eudicotyledoneae	one to five	0.898
Commelinidae	six to ten	0.998
Pentapetalae	one to five	0.998
Superasteridae	one to five	1
Asteridae	one to five	1
Lamiidae	one to five	1
Campanulidae	one to five	1
Superrosidae	one to five	0.998
Rosidae	one to five	0.98
Malvidae	six to ten	0.868
Fabidae	one to five	0.752

Stochastic character mapping
305_A. Filament (binary) (D2d)
ER model, fixed tree, 500 sim

laminar
typical

Node	State	Prob
Angiospermae	typical	0.926
Mesangiospermae	typical	0.99
Magnoliidae	typical	0.92
Monocotyledoneae	typical	0.996
Eudicotyledoneae	typical	1
Commelinidae	typical	1
Pentapetalae	typical	1
Superasteridae	typical	1
Asteridae	typical	1
Lamiidae	typical	1
Campanulidae	typical	0.998
Superrosidae	typical	1
Rosidae	typical	1
Malvidae	typical	1
Fabidae	typical	1

Stochastic character mapping
306_A_Fusion of filaments (D2c)
ER model, fixed tree, 500 sim



Stochastic character mapping
308_A. Fusion of filaments to inner perianth series (D2c)
ER model, fixed tree, 500 sim

free
fused

Node	State	Prob
Angiospermae	free	0.99
Mesangiospermae	free	1
Magnoliidae	free	1
Monocotyledoneae	free	1
Eudicotyledoneae	free	1
Commelinidae	free	0.882
Pentapetalae	free	1
Superasteridae	free	1
Asteridae	free	0.996
Lamiidae	fused	0.512
Campanulidae	free	0.994
Superrosidae	free	1
Rosidae	free	1
Malvidae	free	1
Fabidae	free	1

Stochastic character mapping
311_A. Anther orientation (D2d),
ER model, fixed tree, 500 sim

Node	State	Prob
Angiospermae	introrse	0.858
Mesangiospermae	introrse	0.86
Magnoliidae	extrorse	0.832
Monocotyledoneae	introrse	0.896
Eudicotyledoneae	introrse	0.864
Commelinidae	introrse	1
Pentapetalae	introrse	0.994
Superasteridae	introrse	1
Asteridae	introrse	1
Lamiidae	introrse	1
Campanulidae	introrse	1
Superrosidae	introrse	1
Rosidae	introrse	1
Malvidae	introrse	1
Fabidae	introrse	1

Stochastic character mapping
312_A. Anther attachment (binary) (D2d)
ER model, fixed tree, 500 sim

basifixed
dorsifixed

Node	State	Prob
Angiospermae	basifixed	0.692
Mesangiospermae	basifixed	0.69
Magnoliidae	basifixed	0.738
Monocotyledoneae	basifixed	0.956
Eudicotyledoneae	basifixed	0.718
Commelinidae	basifixed	1
Pentapetalae	basifixed	0.774
Superasteridae	basifixed	0.998
Asteridae	basifixed	1
Lamiidae	dorsifixed	1
Campanulidae	dorsifixed	1
Superrosidae	basifixed	0.54
Rosidae	dorsifixed	0.514
Malvidae	dorsifixed	1
Fabidae	dorsifixed	0.97

Stochastic character mapping
313_A. Anther dehiscence (D2d)
ER model, fixed tree, 500 sim

whorled
spiral

Node	State	Prob
Angiospermae	longitudinal slit	1
Mesangiospermae	longitudinal slit	1
Magnoliidae	longitudinal slit	1
Monocotyledoneae	longitudinal slit	1
Eudicotyledoneae	longitudinal slit	1
Commelinidae	longitudinal slit	1
Pentapetalae	longitudinal slit	1
Superasteridae	longitudinal slit	1
Asteridae	longitudinal slit	1
Lamiidae	longitudinal slit	1
Campanulidae	longitudinal slit	1
Superrosidae	longitudinal slit	1
Rosidae	longitudinal slit	1
Malvidae	longitudinal slit	1
Fabidae	longitudinal slit	1

Stochastic character mapping
314_A. Connective extension (apical) (D2d)
ER model, fixed tree, 500 sim

absent
present

Node	State	Prob
Angiospermae	absent	0.628
Mesangiospermae	absent	0.72
Magnoliidae	present	0.638
Monocotyledoneae	absent	0.906
Eudicotyledoneae	absent	0.836
Commelinidae	absent	1
Pentapetalae	absent	0.982
Superasteridae	absent	1
Asteridae	absent	0.998
Lamiidae	absent	1
Campanulidae	absent	1
Superrosidae	absent	0.994
Rosidae	absent	1
Malvidae	absent	1
Fabidae	absent	1

Stochastic character mapping
330_A. Androecium structural phyllotaxy (D2d)
ER model, fixed tree, 500 sim

whorled
spiral

Node	State	Prob
Angiospermae	whorled	0.89
Mesangiospermae	whorled	1
Magnoliidae	whorled	0.998
Monocotyledoneae	whorled	1
Eudicotyledoneae	whorled	1
Commelinidae	whorled	1
Pentapetalae	whorled	1
Superasteridae	whorled	1
Asteridae	whorled	1
Lamiidae	whorled	1
Campanulidae	whorled	1
Superrosidae	whorled	1
Rosidae	whorled	1
Malvidae	whorled	1
Fabidae	whorled	1

Stochastic character mapping
331_A. Number of androecium structural whorls (D2c)
ER model, fixed tree, 500 sim

Node	State	Prob
Angiospermae	one	0.692
Mesangiospermae	one	0.69
Magnoliidae	one	0.738
Monocotyledoneae	two	0.956
Eudicotyledoneae	one	0.718
Commelinidae	two	1
Pentapetalae	one	0.774
Superasteridae	one	0.998
Asteridae	one	1
Lamiidae	one	1
Campanulidae	one	1
Superrosidae	one	0.54
Rosidae	two	0.514
Malvidae	two	1
Fabidae	two	0.97

Stochastic character mapping
332_A. Androecium structural merism (D2c)
ER model, fixed tree, 500 sim

- dimerous
- trimeorus
- tetramerous
- pentamerous

Node	State	Prob
Angiospermae	trimerous	0.94
Mesangiospermae	trimerous	0.94
Magnoliidae	trimerous	1
Monocotyledoneae	trimerous	1
Eudicotyledoneae	trimerous	0.776
Commelinidae	trimerous	1
Pentapetalae	pentamerous	1
Superasteridae	pentamerous	1
Asteridae	pentamerous	0.998
Lamiidae	pentamerous	1
Campanulidae	pentamerous	1
Superrosidae	pentamerous	1
Rosidae	pentamerous	1
Malvidae	pentamerous	1
Fabidae	pentamerous	1

Stochastic character mapping
400_A. Gynoecium phyllotaxy (D2d)
ER model, fixed tree, 500 sim

- whorled
- spiral

Node	State	Prob
Angiospermae	free	0.968
Mesangiospermae	free	0.976
Magnoliidae	free	0.972
Monocotyledoneae	free	0.824
Eudicotyledoneae	free	0.976
Commelinidae	fused	1
Pentapetalae	free	0.718
Superasteridae	fused	0.774
Asteridae	fused	0.988
Lamiidae	fused	0.996
Campanulidae	fused	1
Superrosidae	fused	0.678
Rosidae	fused	0.898
Malvidae	fused	0.998
Fabidae	fused	0.944


Stochastic character mapping
401_B. Number of structural carpels (D2c)
ER model, fixed tree, 500 sim
one
two
three
four to five
more than five
Node State Prob
Angiospermae more than five 0.912
Mesangiospermae more than five 0.882
Magnoliidae more than five 0.95
Monocotyledoneae three 0.79
Eudicotyledoneae more than five 0.644
Commelinidae three 1
Pentapetalae two 0.514
Superasteridae two 0.522
Asteridae two 0.786
Lamiidae two 1
Campanulidae two 1
Superrosidae two 0.51
Rosidae four to five 0.484
Malvidae four to five 0.994
Fabidae four to five 0.988
Magnoliidae

Stochastic character mapping
403_A_Fusion of ovaries (binary) (Dzi)
ER model, fixed tree, 500 sim

Stochastic character mapping
404_B. Style differentiation (D2d)
ER model, fixed tree, 500 sim

absent
present

Node	State	Prob
Angiospermae	absent	0.632
Mesangiospermae	present	1
Magnoliidae	present	1
Monocotyledoneae	present	1
Eudicotyledoneae	present	1
Commelinidae	present	1
Pentapetalae	present	1
Superasteridae	present	1
Asteridae	present	1
Lamiidae	present	1
Campanulidae	present	1
Superrosidae	present	1
Rosidae	present	1
Malvidae	present	1
Fabidae	present	1

Stochastic character mapping
406_A. Fusion of styles (D2c)
ER model, fixed tree, 500 sim

free
fused

Node	State	Prob
Angiospermae	free	0.968
Mesangiospermae	free	0.976
Magnoliidae	free	0.972
Monocotyledoneae	free	0.824
Eudicotyledoneae	free	0.976
Commelinidae	fused	1
Pentapetalae	free	0.718
Superasteridae	fused	0.774
Asteridae	fused	0.988
Lamiidae	fused	0.996
Campanulidae	fused	1
Superrosidae	fused	0.678
Rosidae	fused	0.898
Malvidae	fused	0.998
Fabidae	fused	0.944

Stochastic character mapping
411_A. Number of ovules per functional carpel (D2c)
ER model, fixed tree, 500 sim

Node	State	Prob
Angiospermae	one	0.79
Mesangiospermae	one	0.82
Magnoliidae	one	0.794
Monocotyledoneae	one	0.796
Eudicotyledoneae	one	0.8
Commelinidae	one	0.922
Pentapetalae	one	0.778
Superasteridae	one	0.948
Asteridae	one	0.952
Lamiidae	one	0.874
Campanulidae	one	0.946
Superrosidae	three or more	0.532
Rosidae	three or more	0.536
Malvidae	three or more	0.682
Fabidae	two	0.484

Stochastic character mapping
412_A. Placentation (D2d)
ER model, fixed tree, 500 sim

- axile
- parietal
- free central
- laminar

Node	State	Prob
Angiospermae	axile	0.742
Mesangiospermae	axile	1
Magnoliidae	axile	0.984
Monocotyledoneae	axile	1
Eudicotyledoneae	axile	1
Commelinidae	axile	1
Pentapetalae	axile	1
Superasteridae	axile	1
Asteridae	axile	1
Lamiidae	axile	1
Campanulidae	axile	1
Superrosidae	axile	1
Rosidae	axile	1
Malvidae	axile	1
Fabidae	axile	1

Stochastic character mapping
5000_A. Number of apertures (D2c)
ER model, fixed tree, 500 sim

Node	State	Prob
Angiospermae	monoaperturate	0.996
Mesangiospermae	monoaperturate	0.996
Magnoliidae	monoaperturate	1
Monocotyledoneae	monoaperturate	1
Eudicotyledoneae	triaperturate	1
Commelinidae	monoaperturate	1
Pentapetalae	triaperturate	1
Superasteridae	triaperturate	1
Asteridae	triaperturate	1
Lamiidae	triaperturate	1
Campanulidae	triaperturate	1
Superrosidae	triaperturate	1
Rosidae	triaperturate	1
Malvidae	triaperturate	1
Fabidae	triaperturate	1

Stochastic character mapping
5002_A. Aperture shape (D2d)
ER model, fixed tree, 500 sim

- elongate
- pore like
- colporate

Node	State	Prob
Angiospermae	elongate	0.96
Mesangiospermae	elongate	0.998
Magnoliidae	elongate	1
Monocotyledoneae	elongate	1
Eudicotyledoneae	elongate	0.994
Commelinidae	elongate	1
Pentapetalae	colporate	0.76
Superasteridae	colporate	0.976
Asteridae	colporate	0.998
Lamiidae	colporate	1
Campanulidae	colporate	1
Superrosidae	colporate	0.988
Rosidae	colporate	1
Malvidae	colporate	1
Fabidae	colporate	1