SUPPLEMENTARY DATA

APPENDIX S1. Taxa used in this study and voucher information.

Abbreviations (except herbarium codes): ASDM = Arizona-Sonora Desert Museum, Tucson, Arizona, USA; cult. = cultivated; DBG = Desert Botanical Garden, Phoenix, Arizona, USA; DELEP = Desert Legume Program of the University of Arizona, Tucson, Arizona, USA; s.n. = *sine numerus* (Latin, no collection number); UA = University of Arizona, Tucson, Arizona, USA; UMBG = Botanical Garden of the University of Munich, Munich, Germany. For herbarium codes see Index Herbariorum (Thiers, continuously updated). For details about clades see Marazzi *et al*. (2006). For GenBank accessions and voucher information about the taxa in the molecular phylogenetic tree see Marazzi and Sanderson (2010), their Appendix S1 in the supplementary material.

Taxon name and authority	**Clade**	**Voucher specimen, locality**	**Deposited at**
Senna alata(L.) Roxb.	II	*Marazzi & al. BM242*, Bolivia, Tarija	CTES, Z
S. aphylla (Cav.) H.S. Irwin & Barneby	VIa	*XDL 91-0486D*, cult. at DELEP	ARIZ, DELEP
S. artemisiodes(DC.) Randell	IVa	*XDL 96-0039*, cult. at DELEP	ARIZ, DELEP
S. aversiflora(Herbert) H.S. Irwin & Barneby	VI	*Queiroz & Marazzi LQ9204*, Brazil, Bahia	HUEFS, Z
S. bracteosa* D. Cardoso & L.P. Queiroz (Fig. 2I)	V	Cardoso &Bastos2052, Brazil, Bahia	HUEFS
S. bracteosa* D. Cardoso & L.P. Queiroz(Fig. 2J)	V	Cardoso & Santana 1306, Brazil, Bahia [type location, see Cardoso and Queiroz (2008)]	BRIT, CEPEC, HUEFS, K, MBM, MO, NY, RB, SP, SPF
S. cana* var. *calva H.S. Irwin & Barneby	V	*Conceiçao & Marazzi AC1132*, Brazil, Bahia	HUEFS, Z
S. costata (J.F. Bailey & C. White) Randell	IVa	*XDL 91-0400D*, cult. at DELEP	ARIZ, DELEP
S. covesiiA. Gray	VII	*Marazzi BM353*, cult. at UA	ARIZ
S. didymobotrya (Fresen.) H.S. Irwin & Barneby	II	*Marazzi & Arrigo BM331*, cult.parking lot, USA, Arizona	ARIZ
S. hirsuta* var. *glaberrima(M.E. Jones) H.S. Irwin & Barneby	VII	*Marazzi BM327*, USA,Arizona	ARIZ, DELEP
S. italica* Mill.	II	*Weavings.n.*, Africa	-
S. martiana (Benth.) H.S. Irwin & Barneby	II	*Queiroz s.n.*, cult. at HUEFS	HUEFS, ARIZ
S. occidentalis (L.) Link	VIIa	*Marazzi & Solís Neffa BM231*, Argentina, Corrientes	CTES, Z
S. pallida (Vahl) H.S. Irwin &Barneby	VI	*XDL 90-0351*, cult. at DELEP	ARIZ, DELEP
S. paradictyon(Vogel) H.S. Irwin &Barneby	II	*Marazzi et al. BM028*, Paraguay, Alto Paraná	CTES, PY, Z
S. pendula (Willd.) H.S. Irwin &Barneby	VIIa	*Marazzi et al.BM222*, Argentina, Corrientes	CTES, Z

S. pilifera(Vogel) H.S. Irwin & Barneby	IVb	*Marazzi et al. BM256*, Bolivia, Santa Cruz	CTES, Z.
Taxon name and authority (cont.)	**Clade**	**Voucher specimen, locality**	**Deposited at**
S. pleurocarpa*var. *pleurocarpa (F. Muell.) Randell	II	*XDL 96-0088*, cult. at DELEP	ARIZ, DELEP
S. purpusii (Brandegee) H.S. Irwin &Barneby	VIIa	*Marazzi BM302*, cult. at DBG	ARIZ, DBG
S. robiniifolia(Benth.) H.S. Irwin &Barneby	VI	*Marazzi BM005*, cult. atUMBGwith nr. 98/3500w	Z
S. tonduzii (Standl.) H.S. Irwin &Barneby	VI	*Marazzi& FloresBM187*, Mexico, Chiapas	MEXU, Z

* Specimen with no collected material available in this study, used for illustration purpose only.

LITERATURE CITED

Cardoso DBOS, Queiroz LPQ. 2008. A New Species of *Senna* (Leguminosae, Caesalpinioideae) from Eastern Brazil. *Novon* **18**: 140–143.

Marazzi B, Endress PK, Paganucci de Queiroz L, Conti E. 2006a. Phylogenetic relationships within *Senna* (Leguminosae, Cassiinae) based on three chloroplast regions: patterns in the evolution of floral symmetry and extrafloral nectaries. *American Journal of Botany* **93**: 288–303.

Marazzi B, Sanderson MJ. 2010. Large-scale patterns of diversification in the widespread legume genus *Senna* and the evolutionary role of extrafloral nectaries. *Evolution* **64**: 3570–3592.

Thiers B. [continuously updated]. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/ih/

APPENDIX S2. Character matrix of EFN diversity in *Senna*.

Characters coded for 88 taxa (*Senna* spp. and outgroups). Proportion of missing data calculated by Mesquite: 0.06439394. Taxon names as in the trees in Appendix S3 consist of abbreviated genus and species (and variety) names, plus collection number in *Senna* species (see Appendix S1 above, and also Marazzi and Sanderson, 2010). Following multistate characters were coded (question marks indicate missing information):

(A) EFN location on plant: 0 = EFNs absent, 1 = leaves, 2 = stipules, 3 = bracts,4 = sepals, 5 = bract scar, 6 = base of pedicels.

(B) Location of EFNs on leaves: 0 = no EFNs on leaves, 1 = EFNs at the base of the petiole (near or on the pulvinus), 2 = along the petiole (well above the base and below the first pair of leaflets), 3 = between the first (i.e., the most proximal) pair of leaflets only, 4 = between the first pair of leaflets and also the subsequent, 5 = between all pairs of leaflets.

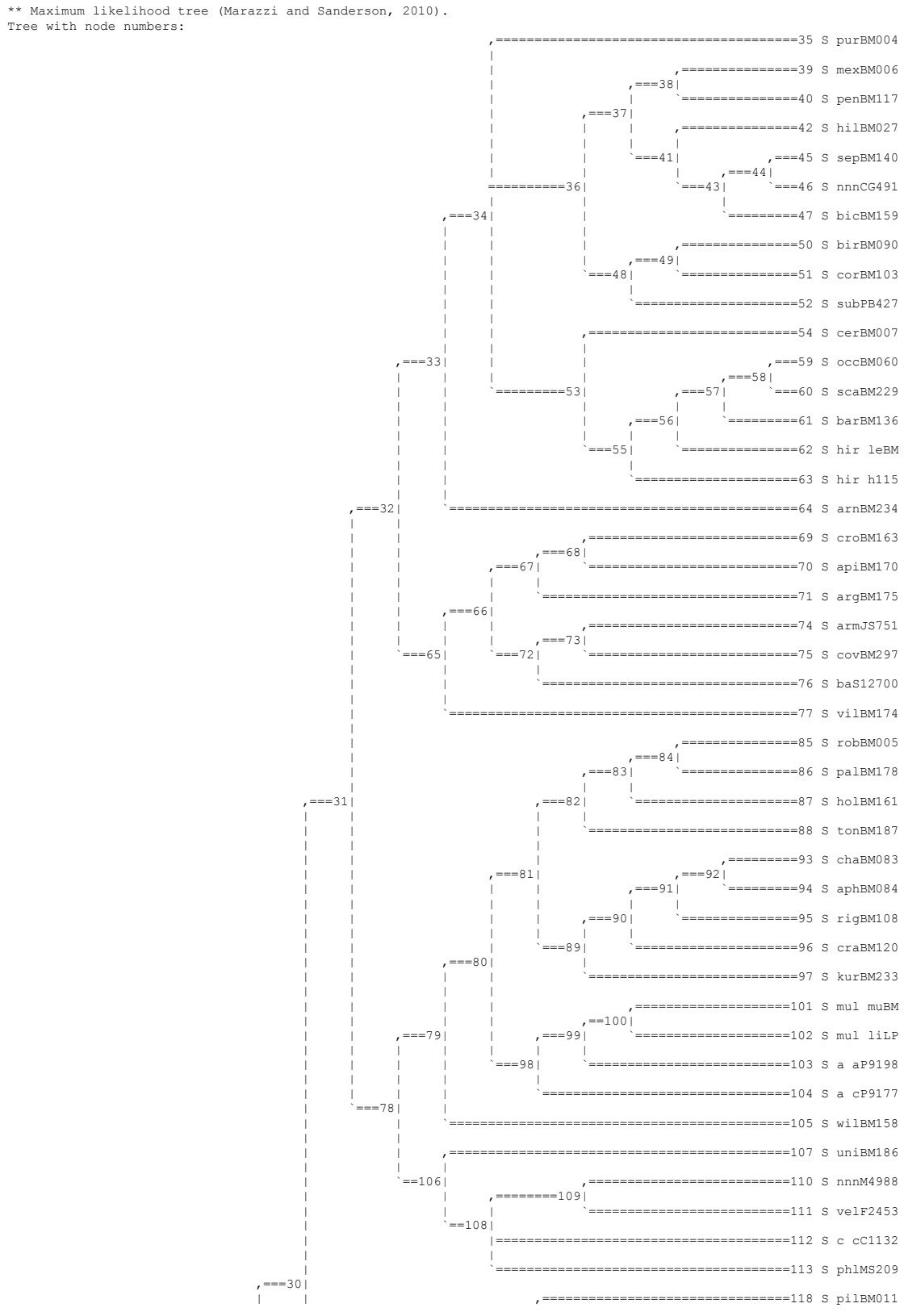
(C) EFN morphology: 0 = EFNs absent, 1 = individualized EFNs, 2 = non-individualized EFNs, 3 = trichomes.

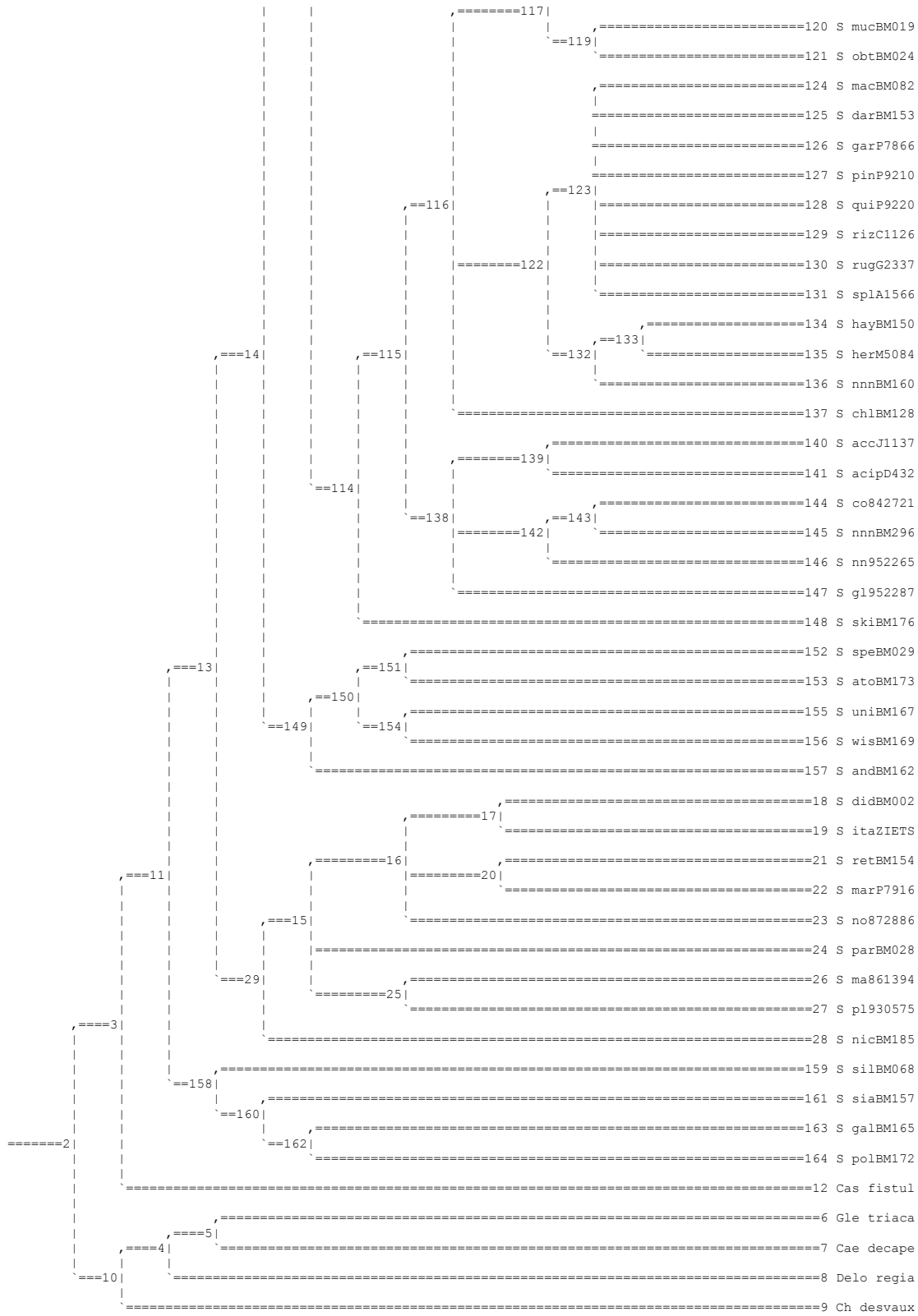
Taxon	**A**	**B**	**C**
Cae decape	0	0	0
Cas fistul	0	0	0
Ch desvaux	1	2	1
Delo regia	0	0	0
Gle triaca	0	0	0
S galBM165	0	0	0
S polBM172	0	0	0
S siaBM157	0	0	0
S silBM068	0	0	0
S didBM002	2	0	2
S itaZIETS	2&3&4	0	?
S ma861394	?	0	?
S marP7916	2&3&4	0	2
S nicBM185	?	0	?
S no872886	?	0	?
S parBM028	3&4	0	2
S pl930575	2&3&4	0	2
S retBM154	?	0	?
S andBM162	0	0	0
S atoBM173	0	0	0
S speBM029	0	0	0
S uniBM167	0	0	0
S wisBM169	0	0	0
S skiBM176	1	3	1
S accJ1137	1	3	1
S acipD432	1	4	1
S co842721	1	3	1
S gl952287	1	3	1
S nn952265	1	4	1
S nnnBM296	1	4	1
S chlBM128	1	3	1
S darBM153	1	3	1
S garP7866	1	3	1
S hayBM150	1	3	1
S herM5084	1	3	1
S macBM082	1	3	1
S mucBM019	1	3	1
S nnnBM160	1	3	1
S obtBM024	1	4	1
S pilBM011	1	5	1
S pinP9210	1	5	1
S quiP9220	1	5	1
S rizC1126	1	3	1
S rugG2337	1	5	1

Taxon (cont.)	A	B	C
S splA1566	1	3	1
S c cC1132	1&6	4	1
S nnnM4988	1&6	4	1
S phlMS209	1&6	5	1
S uniBM186	1&6	4	1
S velF2453	1&6	4	1
S a aP9198	1	4	1
S a cP9177	1	4	1
S aphBM084	?	0	?
S chaBM083	?	0	?
S craBM120	?	0	?
S holBM161	1	3	1
S kurBM233	1	3	1
S mul liLP	1	3	1
S mul muBM	1	3	1
S palBM178	1&6	4	1
S rigBM108	?	0	?
S robBM005	1&6	4	1
S tonBM187	1&6	5	1
S wilBM158	1	5	1
S arnBM234	1	3	1
S barBM136	1	1	1
S bicBM159	1	3	1
S birBM090	1	3	1
S cerBM007	1	1	1
S corBM103	1	3	1
S hilBM027	1	3	1
S hir h115	1	1	1
S hir leBM	1	1	1
S mexBM006	1	3	1
S nnnCG491	1	4	1
S occBM060	1	1	1
S penBM117	1	4	1
S purBM004	1	3	1
S scaBM229	1	1	1
S sepBM140	1	4	1
S subPB427	1	3	1
S apiBM170	1	3	1
S argBM175	1	3	1
S armJS751	1	3	1
S baS12700	1	3	1
S covBM297	1	5	1
S croBM163	1	4	1
S vilBM174	1	4	1

APPENDIX S3. Outputs of ancestral character states analyses in Mesquite.

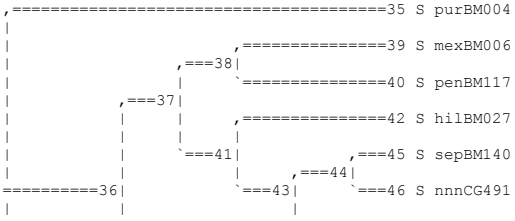
Tracing history of characters A–C over the ML *Senna* tree and over 500 ML bootstrap trees (trees from Marazzi and Sanderson, 2010; only one of 500 ML bootstrap trees shown), and calculating tree values (tree length, CI, RI). See Appendices S1 and S2 (above) for complete specimen names and details on character states and coding, respectively.



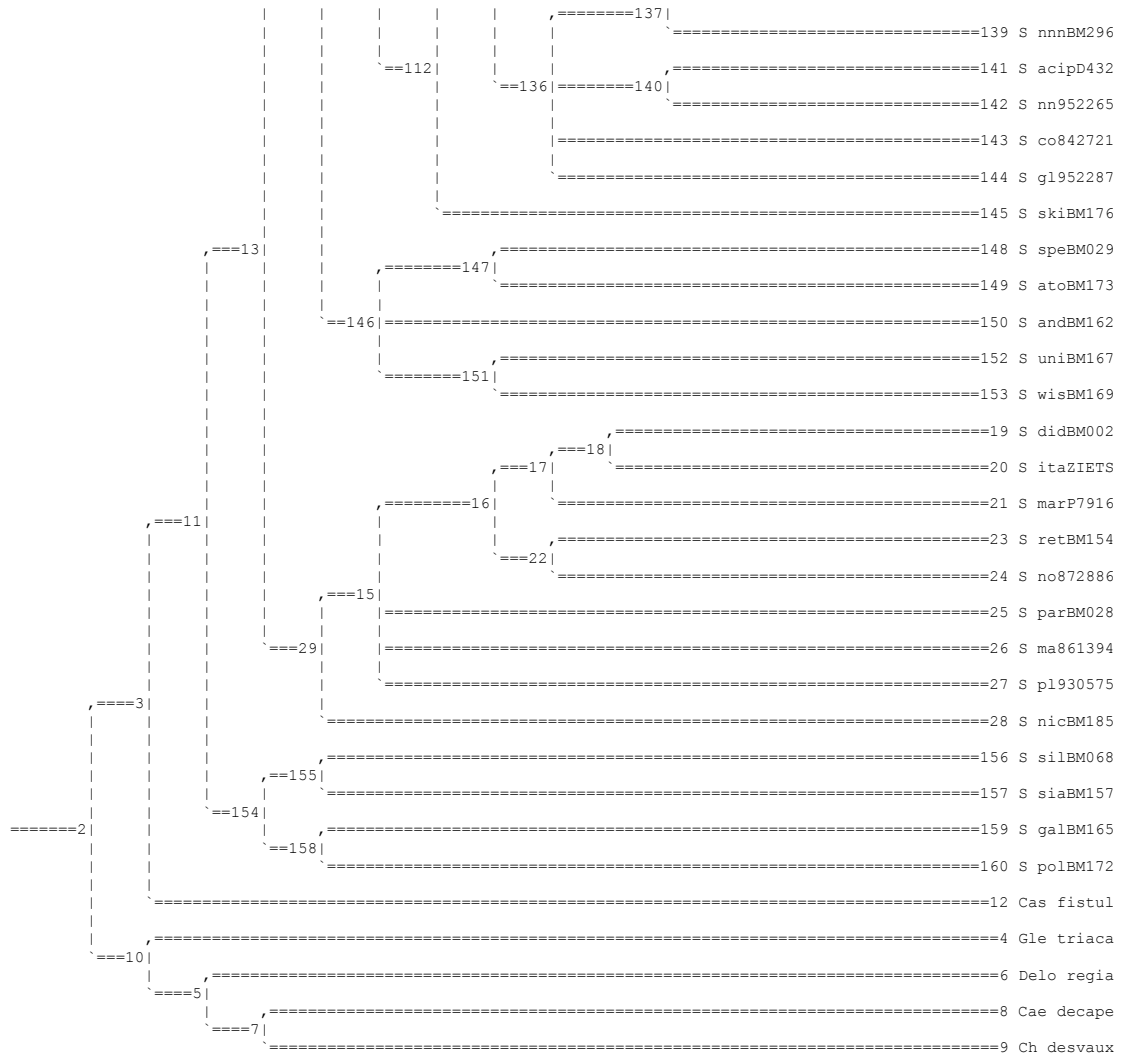


** Tree 1 out of 500 likelihood bootstrap trees from Marazzi and Sanderson (2010).

Tree with node numbers:




47 S bicBM159
50 S birBM090
51 S corBM103
52 S subPB427
54 S cerBM007
57 S occBM060
58 S scaBM229
59 S barBM136
60 S hir leBM
61 S hir h115
62 S arnBM234
68 S croBM163
69 S apiBM170
70 S argBM175
72 S vilBM174
73 S covBM297
74 S baS12700
75 S armJS751
82 S robBM005
83 S palBM178
84 S holBM161
85 S tonBM187
90 S chaBM083
91 S aphBM084
92 S rigBM108
93 S craBM120
94 S kurBM233
99 S mul muBM
100 S mul liLP
101 S a aP9198
102 S a cP9177
103 S wilBM158
105 S uniBM186
108 S nnnM4988
109 S velF2453
110 S c cC1132
111 S phlMS209
116 S pilBM011
119 S macBM082
120 S darBM153
121 S garP7866
122 S pinP9210
123 S quiP9220
124 S rizC1126
125 S rugG2337
126 S splA1566
129 S hayBM150
130 S herM5084
131 S nnnBM160
133 S mucBM019
134 S obtBM024
135 S chlBM128
138 S accJ1137



(A) RECONSTRUCTIONS OF LOCATION OF EFNs ON PLANT

---------- Trace Character History ----------

Character: EFN general location
Parsimony reconstruction (Unordered) [Steps: 19]

node 2: absent
node 3: absent
node 4: absent
node 5: absent
node 6: absent
node 7: absent
node 8: absent
node 9: leaf
node 10: absent
node 11: absent
node 12: absent
node 13: absent
node 14: absent
node 15: stipule,bract,sepal
node 16: stipule,bract,sepal
node 17: stipule,bract,sepal
node 18: stipule
node 19: stipule,bract,sepal
node 20: stipule,bract,sepal
node 21: stipule,bract,sepal
node 22: stipule,bract,sepal
node 23: stipule,bract,sepal
node 24: bract,sepal
node 25: stipule,bract,sepal
node 26: stipule,bract,sepal
node 27: stipule,bract,sepal
node 28: absent,stipule,bract,sepal
node 29: absent,stipule,bract,sepal
node 30: leaf
node 31: leaf
node 32: leaf
node 33: leaf
node 34: leaf
node 35: leaf
node 36: leaf
node 37: leaf

node 38: leaf
node 39: leaf
node 40: leaf
node 41: leaf
node 42: leaf
node 43: leaf
node 44: leaf
node 45: leaf
node 46: leaf
node 47: leaf
node 48: leaf
node 49: leaf
node 50: leaf
node 51: leaf
node 52: leaf
node 53: leaf
node 54: leaf
node 55: leaf
node 56: leaf
node 57: leaf
node 58: leaf
node 59: leaf
node 60: leaf
node 61: leaf
node 62: leaf
node 63: leaf
node 64: leaf
node 65: leaf
node 66: leaf
node 67: leaf
node 68: leaf
node 69: leaf
node 70: leaf
node 71: leaf
node 72: leaf
node 73: leaf
node 74: leaf
node 75: leaf
node 76: leaf
node 77: leaf
node 78: leaf
node 79: leaf
node 80: leaf
node 81: leaf
node 82: leaf
node 83: leaf
node 84: leaf
node 85: leaf,pedicel base
node 86: leaf,pedicel base
node 87: leaf
node 88: leaf,pedicel base
node 89: leaf
node 90: leaf
node 91: leaf
node 92: leaf
node 93: leaf
node 94: leaf
node 95: leaf
node 96: leaf
node 97: leaf
node 98: leaf
node 99: leaf
node 100: leaf
node 101: leaf
node 102: leaf
node 103: leaf
node 104: leaf
node 105: leaf
node 106: leaf
node 107: leaf,pedicel base
node 108: leaf
node 109: leaf
node 110: leaf,pedicel base
node 111: leaf,pedicel base
node 112: leaf,pedicel base
node 113: leaf,pedicel base
node 114: leaf
node 115: leaf
node 116: leaf
node 117: leaf
node 118: leaf
node 119: leaf
node 120: leaf
node 121: leaf
node 122: leaf
node 123: leaf
node 124: leaf
node 125: leaf
node 126: leaf
node 127: leaf
node 128: leaf
node 129: leaf
node 130: leaf
node 131: leaf
node 132: leaf
node 133: leaf
node 134: leaf
node 135: leaf
node 136: leaf
node 137: leaf
node 138: leaf
node 139: leaf
node 140: leaf
node 141: leaf
node 142: leaf

node 143: leaf
node 144: leaf
node 145: leaf
node 146: leaf
node 147: leaf
node 148: leaf
node 149: absent
node 150: absent
node 151: absent
node 152: absent
node 153: absent
node 154: absent
node 155: absent
node 156: absent
node 157: absent
node 158: absent
node 159: absent
node 160: absent
node 161: absent
node 162: absent
node 163: absent
node 164: absent

---------- Trace Character Over Trees ----------

EFN general location
Reconstructed Ancestral States (Parsimony Ancestral States) over 500 trees. Shown for each state at each node is the number of trees on which the reconstructed state set at the node includes that state (it may also include other states as equally or sufficiently optimal according to the reconstruction criteria).

node 2: Node in 500 trees. Optimal states and count of trees with each: absent: 500.0
node 3: Node in 457 trees. Optimal states and count of trees with each: absent: 457.0
node 5: Node in 143 trees. Optimal states and count of trees with each: absent: 143.0
node 7: Node in 65 trees. Optimal states and count of trees with each: absent: 65.0
node 10: Node in 457 trees. Optimal states and count of trees with each: absent: 457.0
node 11: Node in 496 trees. Optimal states and count of trees with each: absent: 496.0
node 13: Node in 353 trees. Optimal states and count of trees with each: absent: 332.23529412; leaf: 6.60695187; stipule: 4.71925134; bract: 4.71925134; sepal: 4.71925134
node 14: Node in 410 trees. Optimal states and count of trees with each: absent: 404.08653846; leaf: 5.91346154
node 15: Node in 487 trees. Optimal states and count of trees with each: absent: 36.857320099; leaf: 8.76116625; stipule: 147.12717122; bract: 147.12717122; sepal: 147.12717122
node 16: Node in 182 trees. Optimal states and count of trees with each: stipule: 60.66666667; bract: 60.66666667; sepal: 60.66666667
node 17: Node in 235 trees. Optimal states and count of trees with each: stipule: 78.33333333; bract: 78.33333333; sepal: 78.33333333
node 18: Node in 497 trees. Optimal states and count of trees with each: stipule: 165.66666667; bract: 165.66666667; sepal: 165.66666667
node 22: Node in 113 trees. Optimal states and count of trees with each: stipule: 37.66666667; bract: 37.66666667; sepal: 37.66666667
node 29: Node in 495 trees. Optimal states and count of trees with each: absent: 114.66239527; leaf: 18.05322819; stipule: 120.76145885; bract: 120.76145885; sepal: 120.76145885
node 30: Node in 466 trees. Optimal states and count of trees with each: leaf: 466.0
node 31: Node in 409 trees. Optimal states and count of trees with each: leaf: 409.0
node 32: Node in 500 trees. Optimal states and count of trees with each: leaf: 500.0
node 33: Node in 363 trees. Optimal states and count of trees with each: leaf: 363.0
node 34: Node in 225 trees. Optimal states and count of trees with each: leaf: 225.0
node 36: Node in 294 trees. Optimal states and count of trees with each: leaf: 294.0
node 37: Node in 495 trees. Optimal states and count of trees with each: leaf: 495.0
node 38: Node in 484 trees. Optimal states and count of trees with each: leaf: 484.0
node 41: Node in 431 trees. Optimal states and count of trees with each: leaf: 431.0
node 43: Node in 480 trees. Optimal states and count of trees with each: leaf: 480.0
node 44: Node in 500 trees. Optimal states and count of trees with each: leaf: 500.0
node 48: Node in 403 trees. Optimal states and count of trees with each: leaf: 403.0
node 49: Node in 227 trees. Optimal states and count of trees with each: leaf: 227.0
node 53: Node in 487 trees. Optimal states and count of trees with each: leaf: 487.0
node 55: Node in 448 trees. Optimal states and count of trees with each: leaf: 448.0
node 56: Node in 479 trees. Optimal states and count of trees with each: leaf: 479.0
node 63: Node in 500 trees. Optimal states and count of trees with each: leaf: 500.0
node 64: Node in 71 trees. Optimal states and count of trees with each: leaf: 71.0
node 65: Node in 26 trees. Optimal states and count of trees with each: leaf: 26.0
node 66: Node in 497 trees. Optimal states and count of trees with each: leaf: 497.0
node 67: Node in 480 trees. Optimal states and count of trees with each: leaf: 480.0
node 71: Node in 6 trees. Optimal states and count of trees with each: leaf: 6.0
node 76: Node in 499 trees. Optimal states and count of trees with each: leaf: 499.0
node 77: Node in 498 trees. Optimal states and count of trees with each: leaf: 498.0
node 78: Node in 477 trees. Optimal states and count of trees with each: leaf: 477.0
node 79: Node in 423 trees. Optimal states and count of trees with each: leaf: 423.0
node 80: Node in 500 trees. Optimal states and count of trees with each: leaf: 500.0
node 81: Node in 499 trees. Optimal states and count of trees with each: leaf: 499.0
node 86: Node in 339 trees. Optimal states and count of trees with each: leaf: 339.0
node 87: Node in 499 trees. Optimal states and count of trees with each: leaf: 499.0
node 88: Node in 262 trees. Optimal states and count of trees with each: leaf: 262.0
node 89: Node in 349 trees. Optimal states and count of trees with each: leaf: 349.0
node 95: Node in 132 trees. Optimal states and count of trees with each: leaf: 132.0
node 96: Node in 496 trees. Optimal states and count of trees with each: leaf: 496.0
node 97: Node in 498 trees. Optimal states and count of trees with each: leaf: 498.0
node 98: Node in 497 trees. Optimal states and count of trees with each: leaf: 497.0
node 104: Node in 498 trees. Optimal states and count of trees with each: leaf: 498.0
node 106: Node in 500 trees. Optimal states and count of trees with each: leaf: 500.0
node 107: Node in 327 trees. Optimal states and count of trees with each: leaf: 327.0
node 112: Node in 496 trees. Optimal states and count of trees with each: leaf: 496.0
node 113: Node in 496 trees. Optimal states and count of trees with each: leaf: 496.0
node 114: Node in 332 trees. Optimal states and count of trees with each: leaf: 332.0
node 115: Node in 86 trees. Optimal states and count of trees with each: leaf: 86.0
node 117: Node in 500 trees. Optimal states and count of trees with each: leaf: 500.0
node 118: Node in 484 trees. Optimal states and count of trees with each: leaf: 484.0
node 127: Node in 415 trees. Optimal states and count of trees with each: leaf: 415.0
node 128: Node in 326 trees. Optimal states and count of trees with each: leaf: 326.0
node 132: Node in 496 trees. Optimal states and count of trees with each: leaf: 496.0
node 136: Node in 395 trees. Optimal states and count of trees with each: leaf: 395.0
node 137: Node in 43 trees. Optimal states and count of trees with each: leaf: 43.0
node 140: Node in 63 trees. Optimal states and count of trees with each: leaf: 63.0
node 146: Node in 387 trees. Optimal states and count of trees with each: absent: 387.0
node 147: Node in 408 trees. Optimal states and count of trees with each: absent: 408.0

node 151: Node in 500 trees. Optimal states and count of trees with each: absent: 500.0
node 154: Node in 484 trees. Optimal states and count of trees with each: absent: 484.0
node 155: Node in 205 trees. Optimal states and count of trees with each: absent: 205.0
node 158: Node in 498 trees. Optimal states and count of trees with each: absent: 498.0

---------- Values for Current Tree ----------

For character 1, Parsimony steps: 19 (unordered)
For character 1, C.I.: 0.94736842
For character 1, R.I.: 0.93333333

==========

(B) RECONSTRUCTIONS OF LOCATION OF EFNs ON PLANT

---------- Trace Character History ----------

Character: Location of leaf EFNs
Parsimony reconstruction (Unordered) [Steps: 24]

node 2: absent
node 3: absent
node 4: absent
node 5: absent
node 6: absent
node 7: absent
node 8: absent
node 9: along petiole
node 10: absent
node 11: absent
node 12: absent
node 13: absent
node 14: absent
node 15: absent
node 16: absent
node 17: absent
node 18: absent
node 19: absent
node 20: absent
node 21: absent
node 22: absent
node 23: absent
node 24: absent
node 25: absent
node 26: absent
node 27: absent
node 28: absent
node 29: absent
node 30: 1. pair
node 31: 1. pair
node 32: 1. pair
node 33: 1. pair
node 34: 1. pair
node 35: 1. pair
node 36: 1. pair
node 37: 1. pair
node 38: 1. pair
node 39: 1. pair
node 40: 1.+2.pairs
node 41: 1. pair
node 42: 1. pair
node 43: 1. pair
node 44: 1.+2.pairs
node 45: 1.+2.pairs
node 46: 1.+2.pairs
node 47: 1. pair
node 48: 1. pair
node 49: 1. pair
node 50: 1. pair
node 51: 1. pair
node 52: 1. pair
node 53: petiole base
node 54: petiole base
node 55: petiole base
node 56: petiole base
node 57: petiole base
node 58: petiole base
node 59: petiole base
node 60: petiole base
node 61: petiole base
node 62: petiole base
node 63: petiole base
node 64: 1. pair
node 65: 1. pair
node 66: 1. pair
node 67: 1. pair
node 68: 1. pair
node 69: 1.+2.pairs
node 70: 1. pair
node 71: 1. pair
node 72: 1. pair
node 73: 1. pair
node 74: 1. pair
node 75: all pairs
node 76: 1. pair
node 77: 1.+2.pairs
node 78: 1. pair,1.+2.pairs
node 79: 1. pair,1.+2.pairs
node 80: 1. pair,1.+2.pairs
node 81: 1. pair,1.+2.pairs
node 82: 1. pair,1.+2.pairs
node 83: 1. pair,1.+2.pairs
node 84: 1.+2.pairs
node 85: 1.+2.pairs

node 86: 1.+2.pairs
node 87: 1. pair
node 88: all pairs
node 89: absent,1. pair,1.+2.pairs
node 90: absent
node 91: absent
node 92: absent
node 93: absent
node 94: absent
node 95: absent
node 96: absent
node 97: 1. pair
node 98: 1. pair,1.+2.pairs
node 99: 1. pair,1.+2.pairs
node 100: 1. pair
node 101: 1. pair
node 102: 1. pair
node 103: 1.+2.pairs
node 104: 1.+2.pairs
node 105: all pairs
node 106: 1.+2.pairs
node 107: 1.+2.pairs
node 108: 1.+2.pairs
node 109: 1.+2.pairs
node 110: 1.+2.pairs
node 111: 1.+2.pairs
node 112: 1.+2.pairs
node 113: all pairs
node 114: 1. pair
node 115: 1. pair
node 116: 1. pair
node 117: 1. pair
node 118: all pairs
node 119: 1. pair
node 120: 1. pair
node 121: 1.+2.pairs
node 122: 1. pair
node 123: 1. pair
node 124: 1. pair
node 125: 1. pair
node 126: 1. pair
node 127: all pairs
node 128: all pairs
node 129: 1. pair
node 130: all pairs
node 131: 1. pair
node 132: 1. pair
node 133: 1. pair
node 134: 1. pair
node 135: 1. pair
node 136: 1. pair
node 137: 1. pair
node 138: 1. pair
node 139: 1. pair
node 140: 1. pair
node 141: 1.+2.pairs
node 142: 1. pair,1.+2.pairs
node 143: 1. pair,1.+2.pairs
node 144: 1. pair
node 145: 1.+2.pairs
node 146: 1.+2.pairs
node 147: 1. pair
node 148: 1. pair
node 149: absent
node 150: absent
node 151: absent
node 152: absent
node 153: absent
node 154: absent
node 155: absent
node 156: absent
node 157: absent
node 158: absent
node 159: absent
node 160: absent
node 161: absent
node 162: absent
node 163: absent
node 164: absent

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---------- Trace Character Over Trees ----------

Location of leaf EFNs
Reconstructed Ancestral States (Parsimony Ancestral States) over 500 trees. Shown for each state at each node is the number of trees on which the reconstructed state set at the node includes that state (it may also include other states as equally or sufficiently optimal according to the reconstruction criteria).

node 2: Node in 500 trees. Optimal states and count of trees with each: absent: 500.0
node 3: Node in 457 trees. Optimal states and count of trees with each: absent: 457.0
node 5: Node in 143 trees. Optimal states and count of trees with each: absent: 143.0
node 7: Node in 65 trees. Optimal states and count of trees with each: absent: 65.0
node 10: Node in 457 trees. Optimal states and count of trees with each: absent: 457.0
node 11: Node in 496 trees. Optimal states and count of trees with each: absent: 496.0
node 13: Node in 353 trees. Optimal states and count of trees with each: absent: 353.0
node 14: Node in 410 trees. Optimal states and count of trees with each: absent: 404.08653846; 1. pair: 5.91346154
node 15: Node in 487 trees. Optimal states and count of trees with each: absent: 487.0
node 16: Node in 182 trees. Optimal states and count of trees with each: absent: 182.0
node 17: Node in 235 trees. Optimal states and count of trees with each: absent: 235.0
node 18: Node in 497 trees. Optimal states and count of trees with each: absent: 497.0
node 22: Node in 113 trees. Optimal states and count of trees with each: absent: 113.0
node 29: Node in 495 trees. Optimal states and count of trees with each: absent: 495.0

node 30: Node in 466 trees. Optimal states and count of trees with each: absent: 14.82306163; 1. pair: 431.72166998; 1.+2.pairs: 19.45526839
node 31: Node in 409 trees. Optimal states and count of trees with each: absent: 22.77087794; 1. pair: 358.20342612; 1.+2.pairs: 28.02569593
node 32: Node in 500 trees. Optimal states and count of trees with each: 1. pair: 488.28125; 1.+2.pairs: 11.71875
node 33: Node in 363 trees. Optimal states and count of trees with each: 1. pair: 363.0
node 34: Node in 225 trees. Optimal states and count of trees with each: 1. pair: 225.0
node 36: Node in 294 trees. Optimal states and count of trees with each: 1. pair: 294.0
node 37: Node in 495 trees. Optimal states and count of trees with each: 1. pair: 495.0
node 38: Node in 484 trees. Optimal states and count of trees with each: 1. pair: 484.0
node 41: Node in 431 trees. Optimal states and count of trees with each: 1. pair: 431.0
node 43: Node in 480 trees. Optimal states and count of trees with each: 1. pair: 480.0
node 44: Node in 500 trees. Optimal states and count of trees with each: 1.+2.pairs: 500.0
node 48: Node in 403 trees. Optimal states and count of trees with each: 1. pair: 403.0
node 49: Node in 227 trees. Optimal states and count of trees with each: 1. pair: 227.0
node 53: Node in 487 trees. Optimal states and count of trees with each: petiole base: 487.0
node 55: Node in 448 trees. Optimal states and count of trees with each: petiole base: 448.0
node 56: Node in 479 trees. Optimal states and count of trees with each: petiole base: 479.0
node 63: Node in 500 trees. Optimal states and count of trees with each: 1. pair: 488.28125; 1.+2.pairs: 11.71875
node 64: Node in 71 trees. Optimal states and count of trees with each: 1. pair: 71.0
node 65: Node in 26 trees. Optimal states and count of trees with each: 1. pair: 26.0
node 66: Node in 497 trees. Optimal states and count of trees with each: 1. pair: 497.0
node 67: Node in 480 trees. Optimal states and count of trees with each: 1. pair: 480.0
node 71: Node in 6 trees. Optimal states and count of trees with each: 1. pair: 2.0; 1.+2.pairs: 2.0; all pairs: 2.0
node 76: Node in 499 trees. Optimal states and count of trees with each: absent: 0.50404040; 1. pair: 248.49191919; 1.+2.pairs: 250.00404040
node 77: Node in 498 trees. Optimal states and count of trees with each: absent: 0.50404858; 1. pair: 247.99190283; 1.+2.pairs: 249.50404858
node 78: Node in 477 trees. Optimal states and count of trees with each: absent: 22.03012048; 1. pair: 227.48493976; 1.+2.pairs: 227.48493976
node 79: Node in 423 trees. Optimal states and count of trees with each: 1. pair: 210.5; 1.+2.pairs: 210.5; all pairs: 2.0
node 80: Node in 500 trees. Optimal states and count of trees with each: 1. pair: 249.24924925; 1.+2.pairs: 248.74874875; all pairs: 2.00200200
node 81: Node in 499 trees. Optimal states and count of trees with each: 1.+2.pairs: 499.0
node 86: Node in 339 trees. Optimal states and count of trees with each: absent: 113.0; 1. pair: 113.33531157; 1.+2.pairs: 112.66468843
node 87: Node in 499 trees. Optimal states and count of trees with each: absent: 499.0
node 88: Node in 262 trees. Optimal states and count of trees with each: absent: 262.0
node 89: Node in 349 trees. Optimal states and count of trees with each: absent: 349.0
node 95: Node in 132 trees. Optimal states and count of trees with each: 1. pair: 44.0; 1.+2.pairs: 44.33846154; all pairs: 43.66153846
node 96: Node in 496 trees. Optimal states and count of trees with each: 1. pair: 247.24313327; 1.+2.pairs: 248.75686673
node 97: Node in 498 trees. Optimal states and count of trees with each: 1. pair: 248.24316109; 1.+2.pairs: 249.75683891
node 98: Node in 497 trees. Optimal states and count of trees with each: 1. pair: 497.0
node 104: Node in 498 trees. Optimal states and count of trees with each: 1.+2.pairs: 498.0
node 106: Node in 500 trees. Optimal states and count of trees with each: 1.+2.pairs: 500.0
node 107: Node in 327 trees. Optimal states and count of trees with each: 1.+2.pairs: 327.0
node 112: Node in 496 trees. Optimal states and count of trees with each: 1. pair: 490.07171315; 1.+2.pairs: 5.92828685
node 113: Node in 496 trees. Optimal states and count of trees with each: 1. pair: 490.07171315; 1.+2.pairs: 5.92828685
node 114: Node in 332 trees. Optimal states and count of trees with each: 1. pair: 332.0
node 115: Node in 86 trees. Optimal states and count of trees with each: 1. pair: 86.0
node 117: Node in 500 trees. Optimal states and count of trees with each: 1. pair: 500.0
node 118: Node in 484 trees. Optimal states and count of trees with each: 1. pair: 484.0
node 127: Node in 415 trees. Optimal states and count of trees with each: 1. pair: 415.0
node 128: Node in 326 trees. Optimal states and count of trees with each: 1. pair: 326.0
node 132: Node in 496 trees. Optimal states and count of trees with each: 1. pair: 496.0
node 136: Node in 395 trees. Optimal states and count of trees with each: 1. pair: 395.0
node 137: Node in 43 trees. Optimal states and count of trees with each: 1. pair: 43.0
node 140: Node in 63 trees. Optimal states and count of trees with each: 1.+2.pairs: 63.0
node 146: Node in 387 trees. Optimal states and count of trees with each: absent: 387.0
node 147: Node in 408 trees. Optimal states and count of trees with each: absent: 408.0
node 151: Node in 500 trees. Optimal states and count of trees with each: absent: 500.0
node 154: Node in 484 trees. Optimal states and count of trees with each: absent: 484.0
node 155: Node in 205 trees. Optimal states and count of trees with each: absent: 205.0
node 158: Node in 498 trees. Optimal states and count of trees with each: absent: 498.0

--------------- Values for Current Tree ---------------

For character 2, Parsimony steps: 23 (unordered)
For character 2, C.I.: 0.21739130
For character 2, R.I.: 0.66037736

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(C) RECONSTRUCTIONS OF MORPHOLOGY OF EFNs

--------------- Trace Character History ---------------

Character: EFN morphology
Parsimony reconstruction (Unordered) [Steps: 3]

node 2: absent
node 3: absent
node 4: absent
node 5: absent
node 6: absent
node 7: absent
node 8: absent
node 9: true
node 10: absent
node 11: absent
node 12: absent
node 13: absent
node 14: absent
node 15: substitutive
node 16: substitutive
node 17: substitutive
node 18: substitutive
node 19: substitutive
node 20: substitutive
node 21: substitutive
node 22: substitutive
node 23: substitutive
node 24: substitutive

node 25: substitutive
node 26: substitutive
node 27: substitutive
node 28: absent,substitutive
node 29: absent,substitutive
node 30: true
node 31: true
node 32: true
node 33: true
node 34: true
node 35: true
node 36: true
node 37: true
node 38: true
node 39: true
node 40: true
node 41: true
node 42: true
node 43: true
node 44: true
node 45: true
node 46: true
node 47: true
node 48: true
node 49: true
node 50: true
node 51: true
node 52: true
node 53: true
node 54: true
node 55: true
node 56: true
node 57: true
node 58: true
node 59: true
node 60: true
node 61: true
node 62: true
node 63: true
node 64: true
node 65: true
node 66: true
node 67: true
node 68: true
node 69: true
node 70: true
node 71: true
node 72: true
node 73: true
node 74: true
node 75: true
node 76: true
node 77: true
node 78: true
node 79: true
node 80: true
node 81: true
node 82: true
node 83: true
node 84: true
node 85: true
node 86: true
node 87: true
node 88: true
node 89: true
node 90: true
node 91: true
node 92: true
node 93: true
node 94: true
node 95: true
node 96: true
node 97: true
node 98: true
node 99: true
node 100: true
node 101: true
node 102: true
node 103: true
node 104: true
node 105: true
node 106: true
node 107: true
node 108: true
node 109: true
node 110: true
node 111: true
node 112: true
node 113: true
node 114: true
node 115: true
node 116: true
node 117: true
node 118: true
node 119: true
node 120: true
node 121: true
node 122: true
node 123: true
node 124: true
node 125: true
node 126: true
node 127: true
node 128: true
node 129: true

node 130: true
node 131: true
node 132: true
node 133: true
node 134: true
node 135: true
node 136: true
node 137: true
node 138: true
node 139: true
node 140: true
node 141: true
node 142: true
node 143: true
node 144: true
node 145: true
node 146: true
node 147: true
node 148: true
node 149: absent
node 150: absent
node 151: absent
node 152: absent
node 153: absent
node 154: absent
node 155: absent
node 156: absent
node 157: absent
node 158: absent
node 159: absent
node 160: absent
node 161: absent
node 162: absent
node 163: absent
node 164: absent

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---------- Trace Character Over Trees ----------

EFN morphology
Reconstructed Ancestral States (Parsimony Ancestral States) over 500 trees. Shown for each state at each node is the number of trees on which the reconstructed state set at the node includes that state (it may also include other states as equally or sufficiently optimal according to the reconstruction criteria).

node 2: Node in 500 trees. Optimal states and count of trees with each: absent: 500.0
node 3: Node in 457 trees. Optimal states and count of trees with each: absent: 457.0
node 5: Node in 143 trees. Optimal states and count of trees with each: absent: 143.0
node 7: Node in 65 trees. Optimal states and count of trees with each: absent: 65.0
node 10: Node in 457 trees. Optimal states and count of trees with each: absent: 457.0
node 11: Node in 496 trees. Optimal states and count of trees with each: absent: 496.0
node 13: Node in 353 trees. Optimal states and count of trees with each: absent: 341.36263736; true: 6.78846154; substitutive: 4.848901098
node 14: Node in 410 trees. Optimal states and count of trees with each: absent: 404.08653846; true: 5.91346154
node 15: Node in 487 trees. Optimal states and count of trees with each: absent: 12.48717949; true: 6.72386588; substitutive: 467.78895464
node 16: Node in 182 trees. Optimal states and count of trees with each: substitutive: 182.0
node 17: Node in 235 trees. Optimal states and count of trees with each: substitutive: 235.0
node 18: Node in 497 trees. Optimal states and count of trees with each: substitutive: 497.0
node 22: Node in 113 trees. Optimal states and count of trees with each: substitutive: 113.0
node 29: Node in 495 trees. Optimal states and count of trees with each: absent: 223.91722810; true: 35.25505294; substitutive: 235.82771896
node 30: Node in 466 trees. Optimal states and count of trees with each: true: 466.0
node 31: Node in 409 trees. Optimal states and count of trees with each: true: 409.0
node 32: Node in 500 trees. Optimal states and count of trees with each: true: 500.0
node 33: Node in 363 trees. Optimal states and count of trees with each: true: 363.0
node 34: Node in 225 trees. Optimal states and count of trees with each: true: 225.0
node 36: Node in 294 trees. Optimal states and count of trees with each: true: 294.0
node 37: Node in 495 trees. Optimal states and count of trees with each: true: 495.0
node 38: Node in 484 trees. Optimal states and count of trees with each: true: 484.0
node 41: Node in 431 trees. Optimal states and count of trees with each: true: 431.0
node 43: Node in 480 trees. Optimal states and count of trees with each: true: 480.0
node 44: Node in 500 trees. Optimal states and count of trees with each: true: 500.0
node 48: Node in 403 trees. Optimal states and count of trees with each: true: 403.0
node 49: Node in 227 trees. Optimal states and count of trees with each: true: 227.0
node 53: Node in 487 trees. Optimal states and count of trees with each: true: 487.0
node 55: Node in 448 trees. Optimal states and count of trees with each: true: 448.0
node 56: Node in 479 trees. Optimal states and count of trees with each: true: 479.0
node 63: Node in 500 trees. Optimal states and count of trees with each: true: 500.0
node 64: Node in 71 trees. Optimal states and count of trees with each: true: 71.0
node 65: Node in 26 trees. Optimal states and count of trees with each: true: 26.0
node 66: Node in 497 trees. Optimal states and count of trees with each: true: 497.0
node 67: Node in 480 trees. Optimal states and count of trees with each: true: 480.0
node 71: Node in 6 trees. Optimal states and count of trees with each: true: 6.0
node 76: Node in 499 trees. Optimal states and count of trees with each: true: 499.0
node 77: Node in 498 trees. Optimal states and count of trees with each: true: 498.0
node 78: Node in 477 trees. Optimal states and count of trees with each: true: 477.0
node 79: Node in 423 trees. Optimal states and count of trees with each: true: 423.0
node 80: Node in 500 trees. Optimal states and count of trees with each: true: 500.0
node 81: Node in 499 trees. Optimal states and count of trees with each: true: 499.0
node 86: Node in 339 trees. Optimal states and count of trees with each: true: 339.0
node 87: Node in 499 trees. Optimal states and count of trees with each: true: 499.0
node 88: Node in 262 trees. Optimal states and count of trees with each: true: 262.0
node 89: Node in 349 trees. Optimal states and count of trees with each: true: 349.0
node 95: Node in 132 trees. Optimal states and count of trees with each: true: 132.0
node 96: Node in 496 trees. Optimal states and count of trees with each: true: 496.0
node 97: Node in 498 trees. Optimal states and count of trees with each: true: 498.0
node 98: Node in 497 trees. Optimal states and count of trees with each: true: 497.0
node 104: Node in 498 trees. Optimal states and count of trees with each: true: 498.0
node 106: Node in 500 trees. Optimal states and count of trees with each: true: 500.0
node 107: Node in 327 trees. Optimal states and count of trees with each: true: 327.0
node 112: Node in 496 trees. Optimal states and count of trees with each: true: 496.0
node 113: Node in 496 trees. Optimal states and count of trees with each: true: 496.0
node 114: Node in 332 trees. Optimal states and count of trees with each: true: 332.0

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node 115:  Node in 86 trees.  Optimal states and count of trees with each: true: 86.0
node 117:  Node in 500 trees.  Optimal states and count of trees with each: true: 500.0
node 118:  Node in 484 trees.  Optimal states and count of trees with each: true: 484.0
node 127:  Node in 415 trees.  Optimal states and count of trees with each: true: 415.0
node 128:  Node in 326 trees.  Optimal states and count of trees with each: true: 326.0
node 132:  Node in 496 trees.  Optimal states and count of trees with each: true: 496.0
node 136:  Node in 395 trees.  Optimal states and count of trees with each: true: 395.0
node 137:  Node in 43 trees.  Optimal states and count of trees with each: true: 43.0
node 140:  Node in 63 trees.  Optimal states and count of trees with each: true: 63.0
node 146:  Node in 387 trees.  Optimal states and count of trees with each: absent: 387.0
node 147:  Node in 408 trees.  Optimal states and count of trees with each: absent: 408.0
node 151:  Node in 500 trees.  Optimal states and count of trees with each: absent: 500.0
node 154:  Node in 484 trees.  Optimal states and count of trees with each: absent: 484.0
node 155:  Node in 205 trees.  Optimal states and count of trees with each: absent: 205.0
node 158:  Node in 498 trees.  Optimal states and count of trees with each: absent: 498.0


--------------- Values for Current Tree ---------------

For character 3, Parsimony steps: 3 (unordered)
For character 3, C.I.: 0.66666667
For character 3, R.I.: 0.93333333

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LITERATURE CITED

Marazzi B, Sanderson MJ. 2010. Large-scale patterns of diversification in the widespread legume genus *Senna* and the evolutionary role of extrafloral nectaries. *Evolution* **64**: 3570–3592.