

**SUPPLEMENTARY MATERIAL****Comparative dating of *Acacia*: combining fossils and multiple phylogenies to infer ages of clades with poor fossil records***Joseph T. Miller*<sup>A,E</sup>, *Daniel J. Murphy*<sup>B</sup>, *Simon Y. W. Ho*<sup>C</sup>, *David J. Cantrill*<sup>B</sup> and *David Seigler*<sup>D</sup><sup>A</sup>Centre for Australian National Biodiversity Research, CSIRO Plant Industry, GPO Box 1600  
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2006, Australia.<sup>D</sup>Department of Plant Biology, University of Illinois, Urbana, IL 61801, USA.<sup>E</sup>Corresponding author. Email: joe.miller@csiro.au**Table S1** Materials used in the study

<b>Taxon</b>	<b>Dataset</b>	<b>Genbank</b>
<i>Acacia abbreviata</i> Maslin	2 3	JF420287 JF420065 JF420395 KC421289 KC796176 JF420499
<i>Acacia adoxa</i> Pedley	2 3	JF420044 AF523076 AF195716 AF195684; AF195703
<i>Acacia ampliceps</i> Maslin	1	KC421930 EU439994 EU811845
<i>Acacia anceps</i> DC.	2 3	JF420244 JF420350 JF419919 JF420130 JF420456
<i>Acacia aneura</i> F.Muell. ex Benth	2 3	JF420259 JF420036 JF420366 JF419935 JF420146 KF048140
<i>Acacia aneura</i> F.Muell. ex Benth.	1 2 3	JF420293 JF420402 KC421323 JQ248740 JF420505
<i>Acacia baeuerlenii</i> Maiden & R.T.Baker	2 3	JF420229 JQ248866 JF420336 JF419909 JF420115 JF420448
<i>Acacia beckleri</i> Tindale	2 3	JF420260 JF420037 JF420367 JF419936

		JF420147 JF420473
<i>Acacia cochlearis</i> (Labill.) H.L.Wendl.	2 3	KC283897 KC200719 JQ943314 AF523156 KC284140 KC957934
<i>Acacia cognata</i> Domin	2 3	JF420246 JF420022 JF420352 JF419921 JF420132 JF420458
<i>Acacia cultriformis</i> A.Cunn. ex G.Don	2 3	JF420278 JF420056 JF420387 KC421263 KC796172 JF420494
<i>Acacia cupularis</i> Domin	2 3	JF420247 JF420023 JF420353 JF419922 JF420133 JF420459
<i>Acacia dealbata</i> Link	2 3	JF420269 JF420378 KC421251 KC955787 JF420485
<i>Acacia dealbata</i> Link	2 3	KC283375 KC200761 JQ942686 KC421315 KC284195
<i>Acacia deanei</i> (R.T.Baker) M.B.Welch, Coombs & McGlynn	2 3	JF420294 JF420403 KC421329 KC955795 JF420506
<i>Acacia dempsteri</i> F.Muell.	2 3	JF420261 JF420038 KF048760 KC957123 KC955784 JF420474
<i>Acacia dorothea</i> Maiden	2 3	JF420232 JF420339 KC421348 KC796182 JF420450
<i>Acacia dunnii</i> (Maiden) Turrill	2 3	KC283351 KC200800 JQ942655 KC421282 KC284236 KC958085
<i>Acacia epacantha</i> (Maslin) Maslin	2 3	JF420040 JF420369 JF419939 JF420150 JF420476
<i>Acacia euthycarpa</i> (J.M.Black) J.M.Black	2 3	JF420282 JF420060 JF420391 KC421268 KC796174 JF420498
<i>Acacia extensa</i> Lindl.	2 3	JF420281 KF048784 JF420390 KC421267 KC796173 JF420497
<i>Acacia falcata</i> Willd.	2 3	JF420233 JQ248877 JF420340 JQ248696 JQ248759 JF420451
<i>Acacia flexifolia</i> A.Cunn. ex Benth.	2 3	JF420234 JQ248879 JF420341 JQ248697 JQ248761 JF420452
<i>Acacia floribunda</i> (Vent.) Willd.	2 3	JF420235 JQ248880 JF420342 JQ248698 JQ248762 JF420453
<i>Acacia glaucissima</i> Maslin	2 3	KC283357 KC200836 JQ942665 KC421293 KC284282 KC958089
<i>Acacia gonoclada</i> F.Muell.	2 3	JF420280 JF420058 JF420389 KC421266

		KC955793 JF420496
<i>Acacia guinetii</i> Maslin	2 3	JF420397 KC421309 KC796177 JF420500
<i>Acacia hakeoides</i> A.Cunn. ex Benth.	2 3	KC283271 KC200594 JF420349 JF419918 JF420129 JF420455
<i>Acacia hakeoides</i> A.Cunn. ex Benth.	2 3	JF420250 JF420026 JF420356 JF419925 JF420136 JF420462
<i>Acacia hakeoides</i> A.Cunn. ex Benth.	2 3	JF420228 JQ248882 JF420335 JQ248701 JQ248765 JF420447
<i>Acacia halliana</i> Maslin	2 3	KC283279 KC200849 JQ942541 KC421209 KC284300 KC957988
<i>Acacia heteroclita</i> Meisn.	2 3	JF420275 KF048782 JF420384 KC421254 KC796170 JF420491
<i>Acacia latipes</i> Benth.	2 3	KC283362 KC200904 JQ942669 KC421297 KC284357 KC958091
<i>Acacia leioderma</i> Maslin	2 3	JF420286 JF420064 JF420394 KC421288 KC796175
<i>Acacia ligulata</i> A.Cunn. ex Benth.	2 3	JF420028 JF420358 JF419927 JF420138 JF420464
<i>Acacia linifolia</i> (Vent.) Willd.	2 3	JF420264 JF420043 JF420373 JF419942 JF420153 JF420479
<i>Acacia mearnsii</i> De Wild.	2 3	KC283312 JF420379 KC421252 JF420160 KC958038
<i>Acacia mearnsii</i> De Wild.	2 3	JF420284 KF048786 JF420393 KC421286 JF420174
<i>Acacia meisneri</i> Lehm. ex Meisn	2 3	JF420271 JF420049 JF420380 JF420161 KC958044
<i>Acacia melanoxyton</i> R.Br.	2 3	JF420314 JF420093 JF420425 KF048618 KC796190 JF420527
<i>Acacia montana</i> Benth.	2 3	JF420297 JF420406 KC421340 JF420186 KC958128
<i>Acacia muelleriana</i> Maiden & R.T.Baker	2 3	JF420252 JF420029 JF420359 KF048604 JF420139 JF420465
<i>Acacia multispicata</i> Benth.	2 3	JF420253 JF420030 JF420360 KF048605 JF420140 JF420466
<i>Acacia murrayana</i> F.Muell. ex Benth.	2 3	JF420317 JF420095 JF420429 KF048620 KC955806 JF420531
<i>Acacia neriifolia</i> A.Cunn. ex Benth.	2 3	JF420291 JF420400 KC421320 JF420181

		KC958108
<i>Acacia pachyacra</i> Maiden & Blakely	2 3	JF420306 KF048791 JF420417 KF048616 KC796186 JF420520
<i>Acacia penninervis</i> Sieber ex DC.	2 3	JF420239 JF420018 JF420385 KF048603 JF420125
<i>Acacia penninervis</i> Sieber ex DC.	2 3	KC283336 KC201005 JQ942636 KC421259 KC284508
<i>Acacia pentadenia</i> Lindl.	2 3	JF420288 JF420066 JF420396 KC421302 JF420178
<i>Acacia perryi</i> Pedley	2 3	JF420274 JF420052 JF420383 JF420164 KC958054
<i>Acacia platycarpa</i> F.Muell.	2 3	JN006090 JN006101 JN006112 JN006121 JN006132
<i>Acacia pravifolia</i> F.Muell.	2 3	JF420230 JF420116 JF420337 KC421347 KC958135
<i>Acacia pravissima</i> F.Muell. ex Benth.	2 3	JF420255 JF420032 JF420362 KF048607 JF420142 JF420468
<i>Acacia pycnantha</i> Benth.	2 3	JF420273 JF420051 JF420382 JF420163 KC958048
<i>Acacia pyrifolia</i> DC.	2 3	JF420238 JF420017 JF420345 KF048602 JF420124
<i>Acacia rostellifera</i> Benth.	2 3	JF420272 JF420050 JF420381 JF420162 KC958046
<i>Acacia saligna</i> (Labill.) H.L.Wendl.	2 3	KC283494 KC201067 JQ942906 KC955805 JF420529
<i>Acacia spectabilis</i> A.Cunn. ex Benth.	2 3	JF420256 JF420033 JF420363 KF048608 JF420143 JF420469
<i>Acacia suaveolens</i> (Sm.) Willd.	2 3	JF420266 JF420046 JF420375 KC421243 JF420156 KC958028
<i>Acacia subrigida</i> Maslin	2 3	JF420307 JF420086 JF420418 KF048617 KC796187 JF420521
<i>Acacia tetragonophylla</i> F.Muell.	2 3	KC283921 KC201123 KC956407 KC421961 KC284666 KC957963
<i>Acacia tetragonophylla</i> F.Muell.	2 3	KC283334 KC201122 JQ942634 KC421257 KC284665 KC958066
<i>Acacia triptera</i> Benth.	2 3	JF420227 JF420334 KC421327 KC796180 KC958117

<i>Acacia triquetra</i> Benth.	2 3	JF420257 JF420034 JF420364 KF048609 JF420144 JF420470
<i>Acacia tumida</i> F.Muell. ex Benth.	1	AF522986
<i>Acacia venulosa</i> Benth.	2 3	JF420268 JF420048 JF420377 KC421246 JF420158 KC958032
<i>Acacia victoriae</i> subsp. <i>arida</i> Pedley	2 3	DQ029310 KF048792 JF420419 KC284685 KC958213
<i>Acacia visco</i> Lorentz ex Griseb.	1	EU812059 AF522982
<i>Acaciella angustissima</i> (Mill.) Britton & Rose var. <i>angustissima</i>	1 2	EU812043 EU811979 EU440019 EU811872
<i>Acaciella glauca</i> (L.) L.Rico	1 2	EU812042 EU440018 EU811871
<i>Acaciella tequilana</i> (S.Watson) Britton & Rose	1 2	EU812044 EU811980 EU440020 EU811873
<i>Albizia bermudiana</i> ined.	1 2	EU812001 EU811943 EU439975 EU811826
<i>Albizia harveyi</i> Fourn.	1 2	EU812003 EU811945 EU439977 EU811828
<i>Albizia julibrissin</i> Durazz.	1 2	EU812010 EU811952 EU439984 EU811835
<i>Albizia kalkora</i> Prain	1 2	EU812063 EU811999 EU440040 EU811895
<i>Albizia procera</i> (Roxb.) Benth.	1 2	EU812033 EU811975 EU440009 EU811861
<i>Anadenanthera colubrina</i> (Vell.) Brenan	1 2	EU812064 EU812000 EU440041 EU811896
<i>Anadenanthera peregrina</i> Speg.	1 2	EU812046 EU811982 EU440022 EU811875
<i>Caesalpinia calycina</i> Benth.	1	EU361899 AY899691
<i>Calliandra juzepczukii</i> Standl.	1 2	EU812019 EU811963 EU439995 EU811846
<i>Calliandra longipedicellata</i> (McVaugh) Macqueen & H.M.Hern.	1 2	EU812004 EU811946 EU439978 EU811829
<i>Chloroleucon mangense</i> (Jacq.) Britton & Rose	1 2	EU812060 EU811996 EU440037 EU811892
<i>Chloroleucon</i> sp.	1 2	EU812015 EU811957 EU439989 EU811840
<i>Cojoba filipes</i> (Vent.) Barneby & J.W.Grimes	1 2	EU812031 EU811973 EU440007 EU811859
<i>Desmanthus</i> sp.	1 2	EU812035 EU811976 EU440011 EU811864
<i>Ebenopsis ebano</i> (Berland.) Barneby & J.W.Grimes	1 2	EU812012 EU811954 EU439986 EU811837
<i>Faidherbia albida</i> (Delile) A.Chev.	1 2	EU812008 EU811950 EU439981 EU811833
<i>Faidherbia albida</i> (Delile) A.Chev.	1 2	EU812007 EU811949 EU439982 EU811832
<i>Gledistia sinensis</i> Lam.	1 2	AY386930 GQ434978 AY899686
<i>Leucaena leucocephala</i> (Lam.) de Wit	2	KF048595 KF048135
<i>Leucaena leucocephala</i> (Lam.) de Wit	1 2	EU812016 EU811958 EU439990 EU811841
<i>Lysiloma tergeminum</i> Benth.	1 2	EU812062 EU811998 EU440039 EU811894
<i>Mariosousa coulteri</i> (Benth.) Seigler & Ebinger	1 2	EU812057 EU811993 EU440034 EU811889
<i>Mariosousa dolichostachya</i> (S. F. Blake) Seigler & Ebinger	1 2	EU812056 EU811992 EU440033 EU811888

<i>Mariosousa millefolia</i> (S.Watson) Seigler & Ebinger	1 2	EU812058 EU811994 EU440035 EU811890
<i>Mimosa foetida</i> Jacq.	1 2	EU812006 EU811948 EU439980 EU811831
<i>Neptunia monosperma</i> F.Muell. ex Benth.	1 2	EU812005 EU811947 EU439979 EU811830
<i>Pararchidendron pruinatum</i> (Benth.) I.C.Nielsen	1 2 3	JF420304 JF420082 AF274127 EU811953 EU439985 EU811836
<i>Paraserianthes lophantha</i> (Willd.) I.C.Nielsen subsp. <i>lophantha</i>	1 2 3	JF420331 KF048780 AF274128 EU811978 EU440016 EU811869
<i>Piptadenia viridiflora</i> (Kunth) Benth.	1 2	EU812020 EU811964 EU439996 EU811847
<i>Pithecellobium unguis-cati</i> (L.) Benth.	1 2	EU812014 EU811956 EU439988 EU811839
<i>Prosopis</i> sp.	1 2	EU812013 EU811955 EU439987 EU811838
<i>Senegalia fructispina</i>	2	EU812018 EU811960 EU439992
<i>Senegalia brevispica</i> (Harms) Seigler & Ebinger	2	EU812037 EU811977 EU440013 EU811866
<i>Senegalia galpinii</i> (Burt Davy) Seigler & Ebinger	1	EU812024 EU440000 EU811851
<i>Senegalia gaumeri</i> (Blake) Britton & Rose	1 2	EU812061 EU811997 EU440038 EU811893
<i>Senegalia gilliesii</i> (Steud.) Seigler & Ebinger	1	EU812018 EU439992 EU811843
<i>Senegalia mellifera</i> subsp. <i>detinens</i> (Busch.) Brenan	1 2	EU812052 EU811988 EU440029 EU811883
<i>Senegalia muricata</i> (L.) Britton & Rose	1 2	EU812032 EU811974 EU440008 EU811860
<i>Senegalia occidentalis</i> (Rose) Britton & Rose	1 2	EU812055 EU811991 EU440032 EU811886
<i>Senegalia picachensis</i> (Brandege) Britton & Rose	1 2	EU812009 EU811951 EU439983 EU811834
<i>Senegalia skleroxyla</i> (Tussac) Seigler & Ebinger	1 2	EU812030 EU811972 EU440006 EU811858
<i>Senegalia sororia</i> (Standl.) Britton & Rose	1 2	EU812017 EU811959 EU439991 EU811842
<i>Senegalia vogeliana</i> Britton & Rose	1	EU812025 EU440001 EU811852
<i>Senna candolleana</i> (Vogel) H.S.Irwin & Barneby	1 2	AY386848 EU361834
<i>Sphinga acatlensis</i> (Benth.) Barneby & J.W.Grimes	1 2	EU812028 EU811971 EU812048 EU811856
<i>Vachelia hockii</i> De Wild.	1	EU812038 EU440014 EU811867
<i>Vachellia choriophylla</i> (Bentham) Seigler & Ebinger	1 2	EU812041 EU440017 EU811870
<i>Vachellia collinsii</i> (Safford) Seigler & Ebinger	1 2	EU812054 EU811990 EU440031 EU811885
<i>Vachellia constricta</i> (Bentham), Seigler & Ebinger	1 2	EU812051 EU811987 EU440028 EU811881

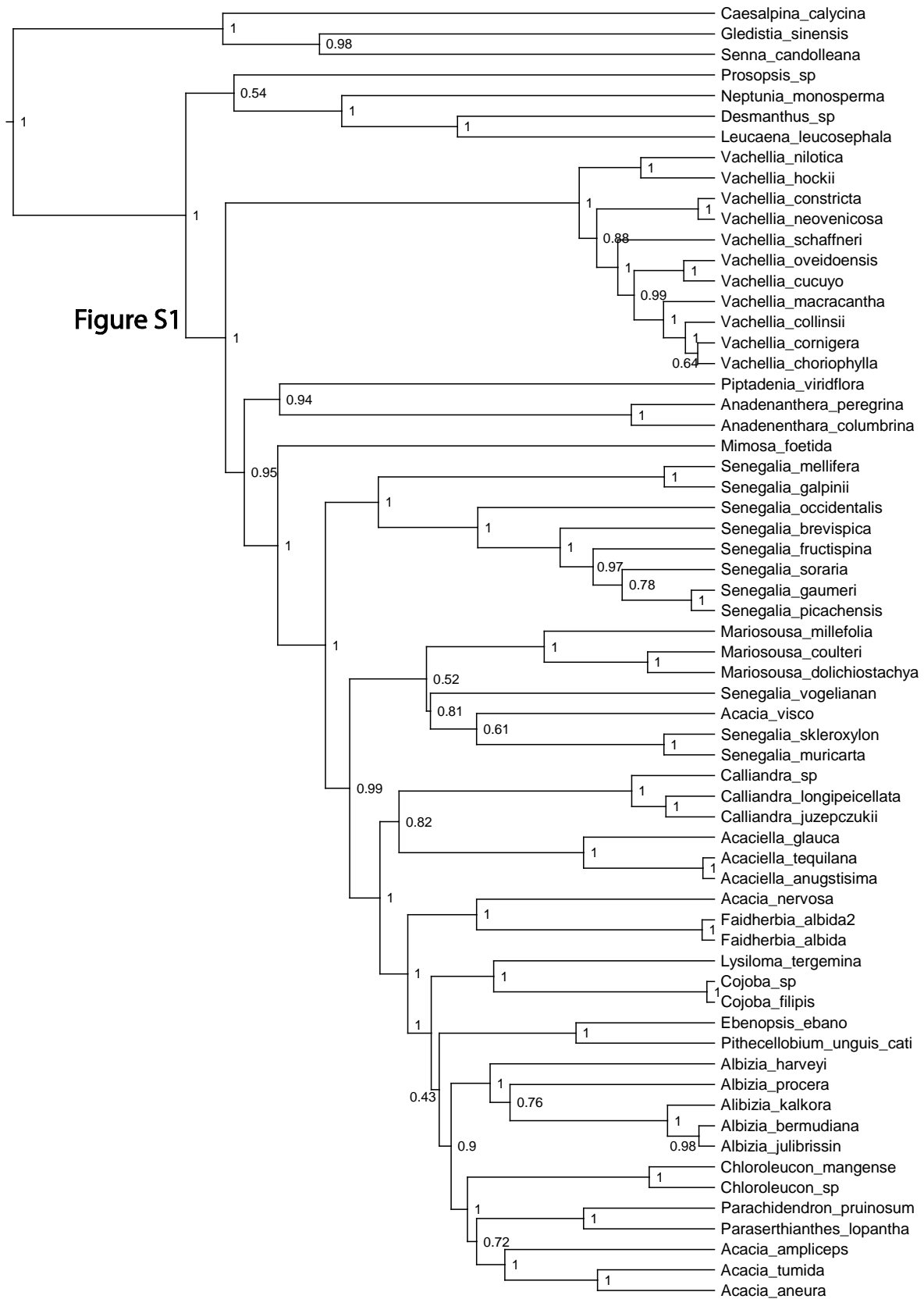
<i>Vachellia cucuyo</i> (Barneby & Zanoni) Seigler & Ebinger	1 2	EU812034 EU440010 EU811862
<i>Vachellia grandicornuta</i> ( Gerstner ) Seigler & Ebinger	1	EU812049 EU440026 EU811879
<i>Vachellia macracantha</i> (Humboldt & Bonpland ex Willdenow) Seigler & Ebinger	1 2	EU812053 EU811989 EU440030 EU811884
<i>Vachellia nilotica</i> (L.) P.J.H.Hurter & Mabb.	1 2	AF523183 AF524993 AF522973 EU811882
<i>Vachellia oviedoensis</i> (R.G.García & M.M.Mejía) Seigler & Ebinger	1 2	EU812029 EU440005 EU811857
<i>Vachellia schaffneri</i> (S. Watson) Seigler & Ebinger	1 2	AF274132 HM020818
<i>Vachellia vernicosa</i> (Britton & Rose), Seigler & Ebinger	1 2	EU811984 EU440025 EU811878
<i>Vachellia cornigera</i> (Linnaeus.) Seigler & Ebinger	1 2	EU812045 EU811981 EU440021 EU811874
<i>Zapoteca nervosa</i> (Urb.) H.M.Hern	1	EU812021 EU439997 EU811848

**Table S2** Divergence dates estimated in this study. The skleroxylon clade and the eight bottom rows are informal clade names

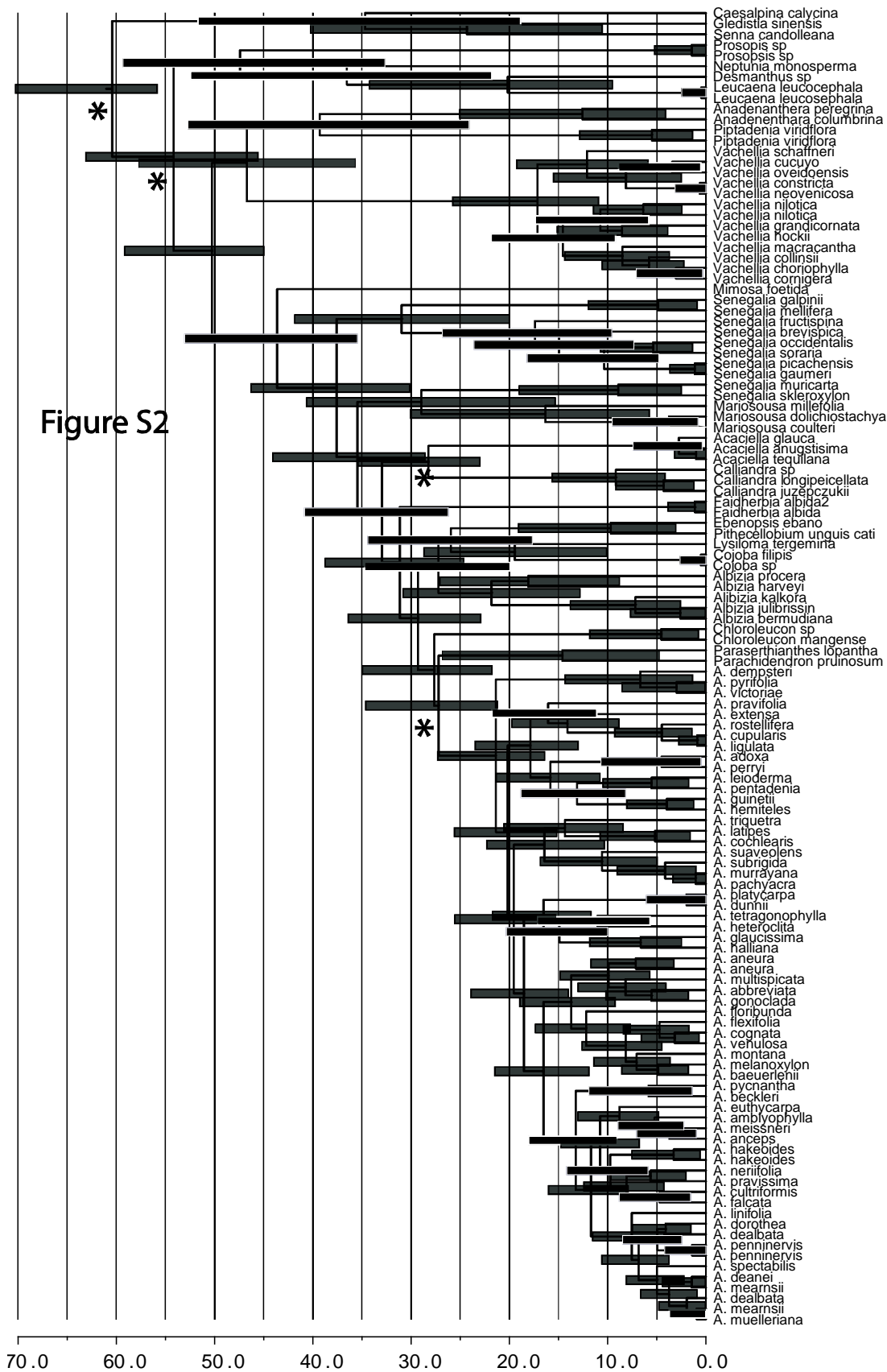
	Mimosoideae			<i>Acacia sl</i>			<i>Acacia</i> fixed crown		
	min	medi an	max	min	medi an	max	min	media n	max
Mimosoideae	45.0	<b>51.4</b>	62.7	45.6	54.2	63.1			
<i>Acacia sl</i>	45.0	<b>49.6</b>	59.2	45.0	<b>50.3</b>	59.2			
<i>Vachellia</i>	8.9	<b>13.7</b>	19.0	11.0	<b>17.2</b>	25.8			
American <i>Vachellia</i>	7.8	<b>11.8</b>	16.7	5.9	<b>14.6</b>	19.2			
African <i>Vachellia</i>	3.4	<b>7.3</b>	12.1	9.2	<b>12.1</b>	21.9			
<i>Senegalia</i>	26.3	<b>33.4</b>	42.0	20.0	<b>31</b>	41.9			
<i>Senegalia</i> "sect. <i>Aculieferum</i> "	1.6	<b>4.9</b>	9.8	0.9	<b>4.9</b>	12.0			
<i>Senegalia</i> "sect. <i>Monacantha</i> "	16.9	<b>23.7</b>	31.6	9.6	<b>17.4</b>	26.8			
"skleroxylon" clade	14.7	<b>27.3</b>	31.6						
<i>Mariosousa</i>	8.0	<b>17.2</b>	32.2	5.8	<b>16.3</b>	30.0			
<i>Acaciella</i>	7.2	<b>13.2</b>	20.0	0.4	<b>2.8</b>	7.4			
<i>Lysiloma/ Cojoba</i>	16.3	<b>22.1</b>	28.1	10.1	<b>19.4</b>	28.7			
<i>Albizia ss</i>	17.0	<b>22.5</b>	27.7	12.8	<b>21.8</b>	30.9			

<i>Calliandra</i>	4.8	<b>8.3</b>	12.7	4.2	<b>9.2</b>	15.6			
<i>Ebenopsis/</i>	6.6	<b>13.8</b>	21.8	3.1	<b>9.7</b>	19.1			
<i>Pithecellobium</i>									
<i>Acacia ss</i>	23.2	<b>24.0</b>	43.0	21.8	<b>27.2</b>	35.0	23.8	<b>26.6</b>	32.0
<i>Paraserianthes</i>									
<i>Acacia</i>	17.1	<b>21.1</b>	25.1	16.4	<b>21.4</b>	27.3	16.1	<b>23.9</b>	30.1
Juliflorae/				9.2	<b>13.7</b>	19.0	8.0	<b>13.2</b>	16.5
Pluinerves									
Plurinerves ss				7.7	<b>12.2</b>	17.4	6.7	<b>10.3</b>	14.2
Juliflorae s.s				5.7	<b>10.0</b>	14.8	7.1	<b>11.0</b>	15.0
Victoriae/Pyrifolia				1.4	<b>6.7</b>	14.3	6.7	<b>12.2</b>	18.2
Murrayana				10.3	<b>16.6</b>	22.3	11.2	<b>17.3</b>	23.1
Pulchelloideae				13.1	<b>17.9</b>	23.5	12.0	<b>18.2</b>	24.4
Botrycephalae/				9.0	<b>13.3</b>	18.0	4.8	<b>7.6</b>	10.7
Phyllodineae									
Botrycephalae							2.1	<b>3.4</b>	5.0





**Figure S1** Bayesian phylogeny inferred from the Mimosoideae dataset, based on three genes and four fossil calibrations. Nodes are labelled with posterior probabilities.



**Figure S2** Dated phylogenetic tree inferred from the *Acacia sl* dataset, based on two genes and four fossil calibrations.

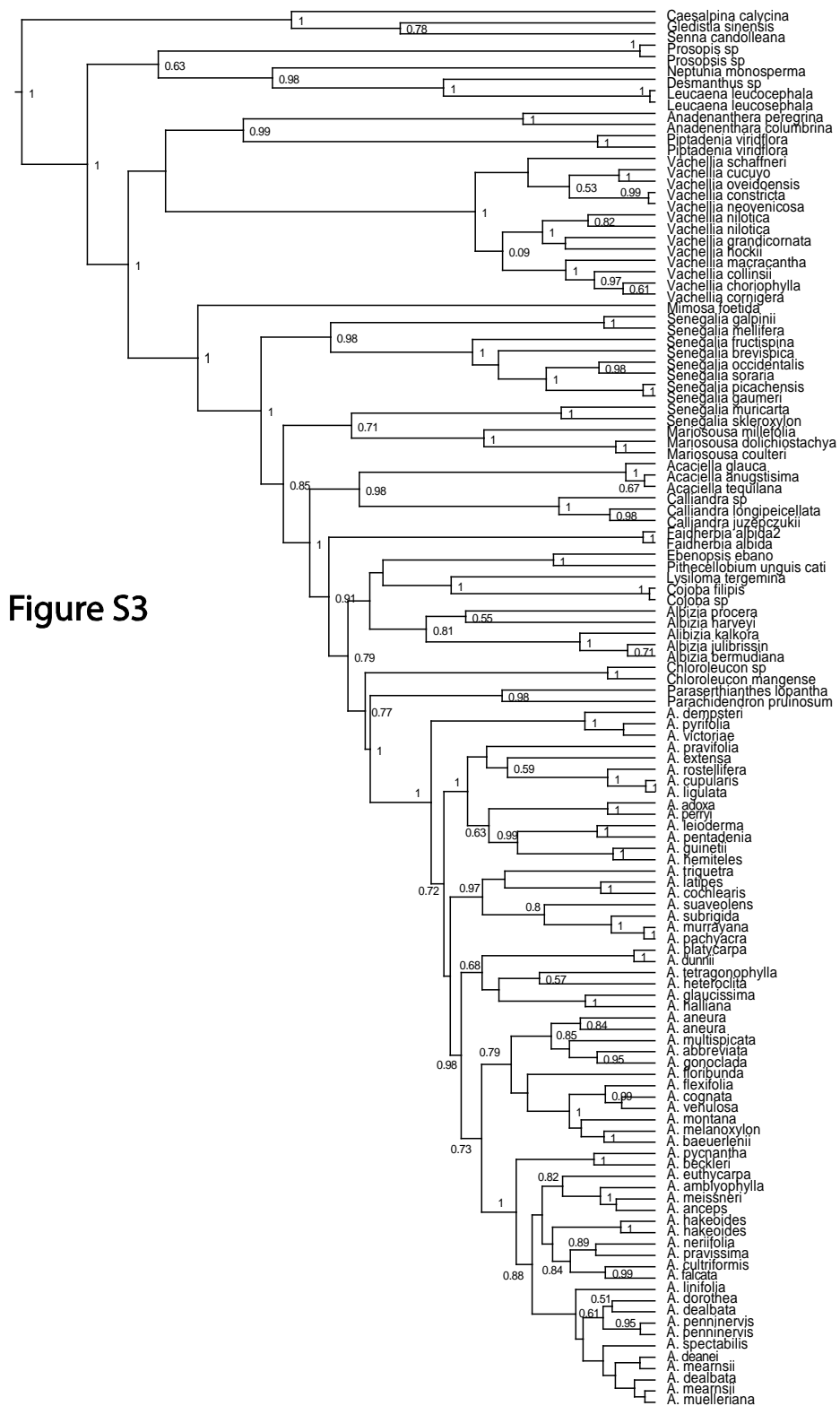
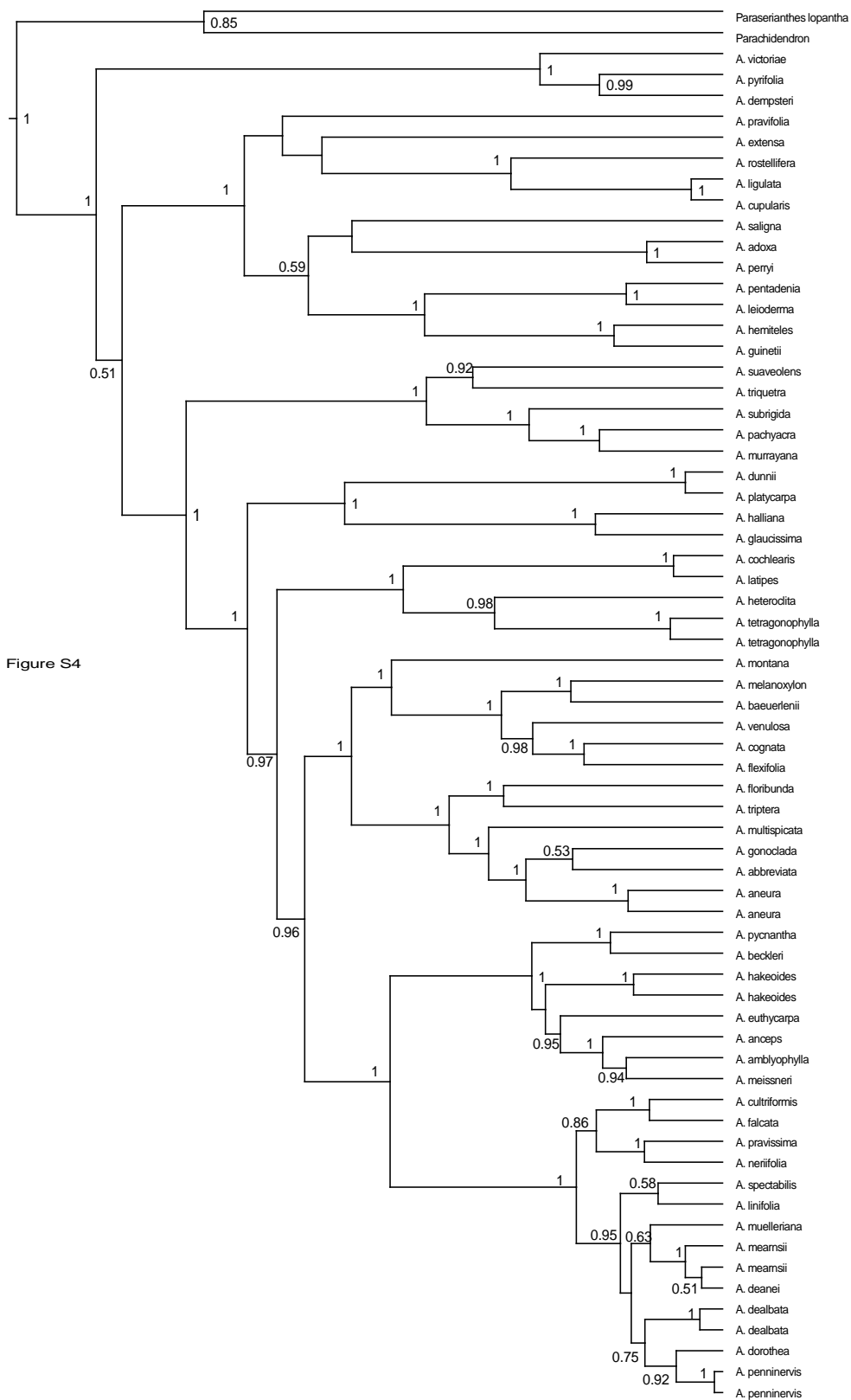


Figure S3

**Figure S3** Bayesian phylogeny inferred from the *Acacia sl* dataset, based on two genes and four fossil calibrations. Nodes are labelled with posterior probabilities.



**Figure S4** Bayesian phylogeny inferred from the *Acacia ss* dataset, based on 6 genes.

Nodes are labelled with posterior probabilities.