**Table S1.** BIO1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| clade | Group.1 | rate | alpha | sigma.sq | theta |
| Alysseae | annual | 0.0438796 | 6.66380991 | 0.00122882 | 5.65231669 |
| Alysseae | perennial | 0.02477475 | 6.66380991 | 0.00160141 | 5.64680254 |
| Antirrhineae | annual | 0.02940751 | 0.04643861 | 2.65E-05 | 5.66873603 |
| Antirrhineae | perennial | 0.01245086 | 0.04643861 | 2.68E-05 | 5.66024456 |
| Apioideae | annual | 0.00058539 | 0.05740227 | 5.01E-05 | 5.64775307 |
| Apioideae | perennial | 0.03378897 | 0.05740227 | 5.02E-05 | 5.64775307 |
| Arabideae | annual | 0.10684912 | 1.52370347 | 0.00149364 | 5.63994426 |
| Arabideae | perennial | 0.14433569 | 1.52370347 | 0.0014937 | 5.62388522 |
| Balsamiaceae | annual | 0.01410781 | 0.15320731 | 6.99E-05 | 5.65668698 |
| Balsamiaceae | perennial | 0.01362342 | 0.15320731 | 6.99E-05 | 5.67899648 |
| Brassiceae | annual | 0.04331724 | 4.8301285 | 0.00194311 | 5.66307004 |
| Brassiceae | perennial | 0.01707056 | 4.8301285 | 0.00184615 | 5.66067065 |
| Cardamineae | annual | 0.05677185 | 1.11450045 | 0.00054358 | 5.65534687 |
| Cardamineae | perennial | 0.0285243 | 1.11450045 | 0.00122269 | 5.63275777 |
| Cardueae | annual | 0.07259066 | 0.0707443 | 3.76E-05 | 5.66395545 |
| Cardueae | perennial | 0.01356082 | 0.0707443 | 3.76E-05 | 5.63997566 |
| CES | annual | 0.08029827 | 0.33840208 | 8.23E-05 | 5.6497311 |
| CES | perennial | 0.02859758 | 0.33840208 | 8.09E-05 | 5.6289667 |
| Chamaecrista | annual | 0.08542555 | 0.36907315 | 1.65E-05 | 5.69291157 |
| Chamaecrista | perennial | 0.01174591 | 0.36907315 | 2.00E-05 | 5.69199213 |
| Chorisporeae | annual | 0.08315248 | 6.46759564 | 0.00136669 | 5.6556097 |
| Chorisporeae | perennial | 0.09301251 | 6.46759564 | 0.00438094 | 5.61525076 |
| Croton | annual | 0.0062452 | 0.08819602 | 1.65E-05 | 5.66504307 |
| Croton | perennial | 0.00428844 | 0.08819602 | 1.65E-05 | 5.69025885 |
| Erysimeae | annual | 0.05569405 | 4.2867926 | 0.00090283 | 5.64377249 |
| Erysimeae | perennial | 0.06482172 | 4.2867926 | 0.00245118 | 5.64349519 |
| Euclidieae | annual | 0.03000192 | 6.63279819 | 0.00924364 | 5.63957406 |
| Euclidieae | perennial | 0.04529422 | 6.63279819 | 0.00758932 | 5.6109697 |
| Eumalvoideae | annual | 0.03829349 | 0.04342246 | 1.84E-05 | 5.69024117 |
| Eumalvoideae | perennial | 0.01247766 | 0.04342246 | 2.30E-05 | 5.67821104 |
| Gesneriaceae | annual | 0.01125012 | 1.46E-06 | 7.05E-06 | 5.73938276 |
| Gesneriaceae | perennial | 0.00243141 | 1.46E-06 | 6.83E-06 | 5.69851976 |
| Grewioideae | annual | 0.01822188 | 0.02790307 | 5.30E-06 | 5.6894835 |
| Grewioideae | perennial | 0.00155572 | 0.02790307 | 5.65E-06 | 5.68949456 |
| Heliophileae | annual | 0.03667496 | 6.09150422 | 0.00024601 | 5.66884398 |
| Heliophileae | perennial | 0.02186931 | 6.09150422 | 0.00018783 | 5.66569729 |
| Hypericum | annual | 0.08537842 | 0.38584394 | 0.00015109 | 5.66297032 |
| Hypericum | perennial | 0.01726038 | 0.38584394 | 0.00015248 | 5.6635204 |
| Lepidieae | annual | 0.28073252 | 0.00872247 | 0.00048522 | 5.66117101 |
| Lepidieae | perennial | 0.21380198 | 0.00872247 | 3.37E-05 | 5.66116977 |
| Lupinus | annual | 0.02506642 | 0.01243178 | 1.55E-05 | 5.67202581 |
| Lupinus | perennial | 0.06983453 | 0.01243178 | 9.55E-05 | 5.6714866 |
| Lysimachieae | annual | 0.03527644 | 0.07063979 | 3.79E-05 | 5.67589926 |
| Lysimachieae | perennial | 0.02933563 | 0.07063979 | 3.90E-05 | 5.65429022 |
| Onagraceae | annual | 0.15590832 | 2.27618099 | 0.00176227 | 5.65971482 |
| Onagraceae | perennial | 0.12897585 | 2.27618099 | 0.00176195 | 5.65664412 |
| Orobanchaceae | annual | 0.04551376 | 0.10480994 | 0.00011349 | 5.65928522 |
| Orobanchaceae | perennial | 0.03955944 | 0.10480994 | 0.0001157 | 5.65210788 |
| Panicoideae | annual | 0.02899001 | 9.22595692 | 0.00329369 | 5.68736146 |
| Panicoideae | perennial | 0.04371949 | 9.22595692 | 0.00229697 | 5.68384497 |
| Polemoniaceae | annual | 0.01151066 | 0.06820139 | 2.61E-05 | 5.65755837 |
| Polemoniaceae | perennial | 0.00894239 | 0.06820139 | 8.35E-05 | 5.65705563 |
| Pooideae | annual | 0.02100831 | 6.21567172 | 0.00179795 | 5.65854111 |
| Pooideae | perennial | 0.03167847 | 6.21567172 | 0.00637541 | 5.63597646 |
| Primulaceae | annual | 0.02420475 | 0.1861174 | 0.00013539 | 5.62820689 |
| Primulaceae | perennial | 0.01241557 | 0.1861174 | 0.00013539 | 5.63476058 |
| Rubieae | annual | 0.07887715 | 7.60596218 | 0.00137441 | 5.6609244 |
| Rubieae | perennial | 0.02367558 | 7.60596218 | 0.00321191 | 5.64852974 |
| Salvia | annual | 0.01863225 | 0.08485602 | 2.61E-05 | 5.66888468 |
| Salvia | perennial | 0.01559416 | 0.08485602 | 2.61E-05 | 5.66545115 |
| Solanaceae | annual | 0.03571926 | 0.13652036 | 7.70E-05 | 5.67014821 |
| Solanaceae | perennial | 0.01489461 | 0.13652036 | 7.70E-05 | 5.67068859 |
| Spermacoceae | annual | 0.03551673 | 0.11004689 | 3.39E-05 | 5.68812404 |
| Spermacoceae | perennial | 0.01325236 | 0.11004689 | 3.39E-05 | 5.67732921 |
| Thelypodieae | annual | 0.04539937 | 0.34730271 | 0.00010741 | 5.66352413 |
| Thelypodieae | perennial | 0.05954099 | 0.34730271 | 0.00010601 | 5.64077808 |

**Table S2.** BIO4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| clade | Group.1 | rate | alpha | sigma.sq | theta |
| Alysseae | annual | 0.04402529 | 0.50513189 | 0.0214897 | 6.90085056 |
| Alysseae | perennial | 0.02115548 | 0.50513189 | 0.0206555 | 6.8964374 |
| Antirrhineae | annual | 0.03074464 | 0.05615667 | 0.00202029 | 6.7449743 |
| Antirrhineae | perennial | 0.013287 | 0.05615667 | 0.00748483 | 6.62181024 |
| Apioideae | annual | 0.05385838 | 0.09432435 | 0.01597978 | 6.83677007 |
| Apioideae | perennial | 0.01000302 | 0.09432435 | 0.01366324 | 6.80066289 |
| Arabideae | annual | 0.52479212 | 0.67707888 | 0.06067607 | 6.90746927 |
| Arabideae | perennial | 0.3550588 | 0.67707888 | 0.14993046 | 6.88769237 |
| Balsamiaceae | annual | 0.01437388 | 0.00400375 | 0.00938075 | 13.9544985 |
| Balsamiaceae | perennial | 0.01525116 | 0.00400375 | 0.00052895 | 5.92161613 |
| Brassiceae | annual | 0.04402116 | 1.51465082 | 0.10740962 | 6.78182407 |
| Brassiceae | perennial | 0.02645235 | 1.51465082 | 0.1001567 | 6.78182379 |
| Cardamineae | annual | 0.05569111 | 2.01050027 | 0.24669257 | 6.81475042 |
| Cardamineae | perennial | 0.03214692 | 2.01050027 | 0.61875634 | 6.81510396 |
| Cardueae | annual | 0.05471326 | 0.164068 | 0.00997412 | 6.83333 |
| Cardueae | perennial | 0.03127461 | 0.164068 | 0.021815 | 6.8371473 |
| CES | annual | 0.0777941 | 0.00390449 | 0.00447383 | 6.75219765 |
| CES | perennial | 0.03003493 | 0.00390449 | 0.00591825 | 6.73773539 |
| Chamaecrista | annual | 0.08230412 | 0.20181379 | 0.00240117 | 6.05770015 |
| Chamaecrista | perennial | 0.01024206 | 0.20181379 | 0.00236646 | 6.04145922 |
| Chorisporeae | annual | 0.07476909 | 3.43309151 | 0.0975446 | 7.09512575 |
| Chorisporeae | perennial | 0.08212299 | 3.43309151 | 0.1243816 | 7.10139911 |
| Croton | annual | 0.03874914 | 0.10079235 | 0.01904948 | 6.93732722 |
| Croton | perennial | 0.00457246 | 0.10079235 | 0.01130981 | 6.05811266 |
| Erysimeae | annual | 0.05077356 | 0.92002517 | 0.05616603 | 6.95733832 |
| Erysimeae | perennial | 0.06039982 | 0.92002517 | 0.06972218 | 6.84685833 |
| Euclidieae | annual | 0.02911251 | 0.53731559 | 0.00364014 | 7.05320916 |
| Euclidieae | perennial | 0.04189974 | 0.53731559 | 0.04962295 | 7.00469944 |
| Eumalvoideae | annual | 0.04550747 | 0.07355345 | 0.02100277 | 6.37815164 |
| Eumalvoideae | perennial | 0.01531847 | 0.07355345 | 0.01325006 | 6.33094879 |
| Gesneriaceae | annual | 0.00318162 | 0.00073853 | 0.00285393 | 6.17085499 |
| Gesneriaceae | perennial | 0.00242287 | 0.00073853 | 0.00279004 | 6.17196296 |
| Grewioideae | annual | 0.01938833 | 0.05716908 | 0.0079496 | 6.28565391 |
| Grewioideae | perennial | 0.00189339 | 0.05716908 | 0.00879124 | 6.13622989 |
| Heliophileae | annual | 0.03419233 | 0.62867033 | 0.00727061 | 6.52207105 |
| Heliophileae | perennial | 0.01728062 | 0.62867033 | 0.004512 | 6.51685737 |
| Hypericum | annual | 0.09399561 | 0.02725369 | 0.06798064 | 6.93723798 |
| Hypericum | perennial | 0.01269791 | 0.02725369 | 0.00794815 | 6.83169659 |
| Lepidieae | annual | 0.25400584 | 1.14314901 | 0.17858675 | 6.79070592 |
| Lepidieae | perennial | 0.20257109 | 1.14314901 | 0.18199736 | 6.68723438 |
| Lupinus | annual | 0.04310612 | 0.04786416 | 0.00280172 | 6.67441324 |
| Lupinus | perennial | 0.11680511 | 0.04786416 | 0.03104991 | 4.87468226 |
| Lysimachieae | annual | 0.03684639 | 0.0181623 | 0.00073335 | 6.85649666 |
| Lysimachieae | perennial | 0.02895284 | 0.0181623 | 0.01024726 | 6.74457896 |
| Onagraceae | annual | 0.05946736 | 0.05839793 | 0.01966654 | 6.59235285 |
| Onagraceae | perennial | 0.00386964 | 0.05839793 | 0.02759087 | 6.59038337 |
| Orobanchaceae | annual | 0.04635661 | 0.1061356 | 0.01752305 | 6.75953878 |
| Orobanchaceae | perennial | 0.04025596 | 0.1061356 | 0.02163064 | 6.77726258 |
| Panicoideae | annual | 0.03284142 | 7.3301921 | 1.18361673 | 6.30995609 |
| Panicoideae | perennial | 0.04869404 | 7.3301921 | 1.18361673 | 6.30995609 |
| Polemoniaceae | annual | 0.01171329 | 0.0124009 | 0.00378928 | 6.61445969 |
| Polemoniaceae | perennial | 0.00820808 | 0.0124009 | 0.00447191 | 5.95634138 |
| Pooideae | annual | 0.02059462 | 0.91006226 | 0.06981983 | 6.79387246 |
| Pooideae | perennial | 0.02835526 | 0.91006226 | 0.22768235 | 6.79387224 |
| Primulaceae | annual | 0.02537533 | 2.75171986 | 0.22837268 | 6.96082126 |
| Primulaceae | perennial | 0.01166081 | 2.75171986 | 0.20583799 | 6.84584095 |
| Rubieae | annual | 0.11559292 | 0.73390042 | 0.01330869 | 6.78873939 |
| Rubieae | perennial | 0.01060442 | 0.73390042 | 0.06720687 | 6.79041683 |
| Salvia | annual | 0.01671827 | 0.04699644 | 0.01048412 | 6.89295788 |
| Salvia | perennial | 0.01561789 | 0.04699644 | 0.01224901 | 6.58687126 |
| Solanaceae | annual | 0.03175675 | 0.10939134 | 0.02884998 | 6.34154496 |
| Solanaceae | perennial | 0.01342037 | 0.10939134 | 0.0281287 | 6.26688753 |
| Spermacoceae | annual | 0.04342677 | 0.15412548 | 0.03526634 | 6.24154558 |
| Spermacoceae | perennial | 0.00688428 | 0.15412548 | 0.03213335 | 6.30131514 |
| Thelypodieae | annual | 0.04375139 | 0.00783391 | 0.00513416 | 6.7591833 |
| Thelypodieae | perennial | 0.07228538 | 0.00783391 | 0.00817083 | 6.68778877 |

Table S3. BIO5

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| clade | Group.1 | rate | alpha | sigma.sq | theta |
| Alysseae | annual | 0.04425457 | 2.82044388 | 0.00046104 | 5.70589138 |
| Alysseae | perennial | 0.02518721 | 2.82044388 | 0.00051073 | 5.70120769 |
| Antirrhineae | annual | 0.03031724 | 0.09562457 | 3.33E-05 | 5.71280648 |
| Antirrhineae | perennial | 0.01284412 | 0.09562457 | 4.40E-05 | 5.7086574 |
| Apioideae | annual | 0.05876041 | 0.14644361 | 7.44E-05 | 5.70679809 |
| Apioideae | perennial | 0.00627024 | 0.14644361 | 7.43E-05 | 5.69449996 |
| Arabideae | annual | 0.11370213 | 2.85991638 | 0.00170142 | 5.69139876 |
| Arabideae | perennial | 0.14269825 | 2.85991638 | 0.0018734 | 5.67541569 |
| Balsamiaceae | annual | 0.01388103 | 0.58288565 | 0.00019675 | 5.69603103 |
| Balsamiaceae | perennial | 0.01108232 | 0.58288565 | 0.00013285 | 5.6969941 |
| Brassiceae | annual | 0.04699898 | 3.24276752 | 0.00137183 | 5.70940182 |
| Brassiceae | perennial | 0.01527256 | 3.24276752 | 0.00157252 | 5.70927405 |
| Cardamineae | annual | 0.05377991 | 3.2632822 | 0.00121778 | 5.69961339 |
| Cardamineae | perennial | 0.032428 | 3.2632822 | 0.0014688 | 5.68396766 |
| Cardueae | annual | 0.04871319 | 0.09687431 | 4.17E-05 | 5.72076313 |
| Cardueae | perennial | 0.03332827 | 0.09687431 | 4.17E-05 | 5.70053771 |
| CES | annual | 0.09100693 | 0.25476791 | 3.76E-05 | 5.69817177 |
| CES | perennial | 0.03158301 | 0.25476791 | 5.42E-05 | 5.66537602 |
| Chamaecrista | annual | 0.06983725 | 0.46858579 | 2.52E-05 | 5.71545846 |
| Chamaecrista | perennial | 0.01246693 | 0.46858579 | 2.55E-05 | 5.71211278 |
| Chorisporeae | annual | 0.07616816 | 1.53255972 | 0.00021348 | 5.72108751 |
| Chorisporeae | perennial | 0.08669855 | 1.53255972 | 0.00032482 | 5.66559455 |
| Croton | annual | 0.01895065 | 0.1323376 | 2.04E-05 | 5.71590343 |
| Croton | perennial | 0.00492704 | 0.1323376 | 2.04E-05 | 5.71097597 |
| Erysimeae | annual | 0.06234572 | 1.81727809 | 0.00054987 | 5.70232049 |
| Erysimeae | perennial | 0.05857594 | 1.81727809 | 0.00082668 | 5.69286933 |
| Euclidieae | annual | 0.02896242 | 4.95123364 | 0.00904794 | 5.70626809 |
| Euclidieae | perennial | 0.04619274 | 4.95123364 | 0.00048371 | 5.65967287 |
| Eumalvoideae | annual | 0.03944987 | 0.06236298 | 2.78E-05 | 5.7082662 |
| Eumalvoideae | perennial | 0.01354125 | 0.06236298 | 2.78E-05 | 5.70811508 |
| Gesneriaceae | annual | 0.00334229 | 0.05270552 | 9.74E-06 | 5.70236796 |
| Gesneriaceae | perennial | 0.00264402 | 0.05270552 | 9.73E-06 | 5.70198224 |
| Grewioideae | annual | 0.01893903 | 0.14106783 | 1.30E-05 | 5.72100168 |
| Grewioideae | perennial | 0.00151463 | 0.14106783 | 1.19E-05 | 5.71092692 |
| Heliophileae | annual | 0.0357692 | 2.34640908 | 0.00013408 | 5.70831532 |
| Heliophileae | perennial | 0.02175662 | 2.34640908 | 0.00010853 | 5.70446631 |
| Hypericum | annual | 0.08843732 | 0.11337648 | 0.00021589 | 5.71000005 |
| Hypericum | perennial | 0.0182061 | 0.11337648 | 4.25E-05 | 5.70668625 |
| Lepidieae | annual | 0.24857415 | 4.26456567 | 0.00268474 | 5.71064194 |
| Lepidieae | perennial | 0.20838006 | 4.26456567 | 0.00277999 | 5.705299 |
| Lupinus | annual | 0.05797418 | 0.03439922 | 2.65E-05 | 5.70236488 |
| Lupinus | perennial | 0.13153395 | 0.03439922 | 7.67E-05 | 5.69817026 |
| Lysimachieae | annual | 0.03323861 | 0.16572421 | 3.63E-05 | 5.71469912 |
| Lysimachieae | perennial | 0.02841232 | 0.16572421 | 3.71E-05 | 5.69988256 |
| Onagraceae | annual | 0.03641358 | 0.67560333 | 0.0004794 | 5.71586994 |
| Onagraceae | perennial | 0.00543767 | 0.67560333 | 0.00045825 | 5.6957791 |
| Orobanchaceae | annual | 0.04609974 | 0.34577101 | 0.00011566 | 5.70479609 |
| Orobanchaceae | perennial | 0.04319785 | 0.34577101 | 0.00013263 | 5.70094528 |
| Panicoideae | annual | 0.02473338 | 2.23586369 | 0.00042825 | 5.71684926 |
| Panicoideae | perennial | 0.03880131 | 2.23586369 | 0.00039091 | 5.71230186 |
| Polemoniaceae | annual | 0.01165917 | 0.09109349 | 3.75E-05 | 5.71668617 |
| Polemoniaceae | perennial | 0.00876047 | 0.09109349 | 4.22E-05 | 5.69266014 |
| Pooideae | annual | 0.01997802 | 1.79546201 | 0.00049092 | 5.70839621 |
| Pooideae | perennial | 0.0306571 | 1.79546201 | 0.00121053 | 5.68587639 |
| Primulaceae | annual | 0.02498328 | 0.21131656 | 0.00010666 | 5.68146218 |
| Primulaceae | perennial | 0.01184284 | 0.21131656 | 0.00010748 | 5.68045901 |
| Rubieae | annual | 0.05448645 | 4.40248025 | 0.00075548 | 5.70546933 |
| Rubieae | perennial | 0.04163527 | 4.40248025 | 0.00086976 | 5.69494975 |
| Salvia | annual | 0.02069279 | 0.08465005 | 2.74E-05 | 5.71564015 |
| Salvia | perennial | 0.01502724 | 0.08465005 | 3.43E-05 | 5.70519573 |
| Solanaceae | annual | 0.02891487 | 0.15523176 | 7.65E-05 | 5.7001863 |
| Solanaceae | perennial | 0.01337719 | 0.15523176 | 7.65E-05 | 5.70001728 |
| Spermacoceae | annual | 0.03506212 | 0.04059133 | 9.92E-06 | 5.71121359 |
| Spermacoceae | perennial | 0.01202575 | 0.04059133 | 1.00E-05 | 5.70865015 |
| Thelypodieae | annual | 0.04322226 | 0.11086913 | 6.73E-05 | 5.72341629 |
| Thelypodieae | perennial | 0.07238157 | 0.11086913 | 9.21E-05 | 5.68001463 |

Table S4. BIO6

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| clade | Group.1 | rate | alpha | sigma.sq | theta |
| Alysseae | annual | 0.04472623 | 2.96503564 | 0.00178492 | 5.60076864 |
| Alysseae | perennial | 0.02478184 | 2.96503564 | 0.00219527 | 5.5984029 |
| Antirrhineae | annual | 0.02848683 | 0.03742949 | 4.22E-05 | 5.62559986 |
| Antirrhineae | perennial | 0.01220293 | 0.03742949 | 4.71E-05 | 5.69633689 |
| Apioideae | annual | 0.01190875 | 0.1005569 | 0.00016355 | 5.61684919 |
| Apioideae | perennial | 0.02026953 | 0.1005569 | 0.00016355 | 5.59624181 |
| Arabideae | annual | 0.1131574 | 1.00919909 | 0.00225588 | 5.58165672 |
| Arabideae | perennial | 0.14555317 | 1.00919909 | 0.00225588 | 5.57231951 |
| Balsamiaceae | annual | 0.01428589 | 0.00316519 | 2.64E-05 | 5.61634716 |
| Balsamiaceae | perennial | 0.01352837 | 0.00316519 | 4.68E-05 | 9.40136049 |
| Brassiceae | annual | 0.04830821 | 6.35900042 | 0.00411011 | 5.61942721 |
| Brassiceae | perennial | 0.02026394 | 6.35900042 | 0.00443601 | 5.61443573 |
| Cardamineae | annual | 0.05078855 | 9.75096861 | 0.00691248 | 5.60377737 |
| Cardamineae | perennial | 0.03177057 | 9.75096861 | 0.02980824 | 5.58540293 |
| Cardueae | annual | 0.06227451 | 0.06880442 | 0.00010617 | 5.61370299 |
| Cardueae | perennial | 0.02301537 | 0.06880442 | 0.0001068 | 5.58938693 |
| CES | annual | 0.0791401 | 0.00396446 | 7.98E-05 | 5.57178955 |
| CES | perennial | 0.03479396 | 0.00396446 | 1.07E-05 | 5.56875346 |
| Chamaecrista | annual | 0.09622943 | 0.11880452 | 1.82E-05 | 5.67148368 |
| Chamaecrista | perennial | 0.01146116 | 0.11880452 | 1.83E-05 | 5.6711077 |
| Chorisporeae | annual | 0.08033507 | 8.41196231 | 0.00321585 | 5.58656082 |
| Chorisporeae | perennial | 0.08755152 | 8.41196231 | 0.00941716 | 5.53147387 |
| Croton | annual | 0.02991996 | 0.05484939 | 4.80E-05 | 5.66243354 |
| Croton | perennial | 0.00530731 | 0.05484939 | 4.75E-05 | 5.66244962 |
| Erysimeae | annual | 0.05955994 | 0.39318421 | 0.00032684 | 5.58871394 |
| Erysimeae | perennial | 0.06206891 | 0.39318421 | 0.00078375 | 5.591116 |
| Euclidieae | annual | 0.03139276 | 1.67154646 | 0.00311077 | 5.57249656 |
| Euclidieae | perennial | 0.05188074 | 1.67154646 | 0.00392761 | 5.54840272 |
| Eumalvoideae | annual | 0.03826592 | 0.04090619 | 4.44E-05 | 5.66130735 |
| Eumalvoideae | perennial | 0.01349127 | 0.04090619 | 4.44E-05 | 5.64490202 |
| Gesneriaceae | annual | 0.00597533 | 0.00011239 | 1.81E-05 | 7.93344527 |
| Gesneriaceae | perennial | 0.00232387 | 0.00011239 | 1.74E-05 | 5.69702837 |
| Grewioideae | annual | 0.01761991 | 0.02822903 | 2.15E-05 | 5.66027413 |
| Grewioideae | perennial | 0.001786 | 0.02822903 | 2.67E-05 | 5.66292423 |
| Heliophileae | annual | 0.03500753 | 0.99048755 | 8.42E-05 | 5.62648548 |
| Heliophileae | perennial | 0.02276974 | 0.99048755 | 0.00010956 | 5.62437744 |
| Hypericum | annual | 0.07730112 | 0.42836443 | 0.00043481 | 5.62264575 |
| Hypericum | perennial | 0.01801538 | 0.42836443 | 0.00040052 | 5.62313186 |
| Lepidieae | annual | 0.25911108 | 0.13251048 | 0.00050075 | 5.61405362 |
| Lepidieae | perennial | 0.21785597 | 0.13251048 | 0.0003173 | 5.61464612 |
| Lupinus | annual | 0.04801391 | 0.00037044 | 1.77E-05 | 5.61983629 |
| Lupinus | perennial | 0.09070246 | 0.00037044 | 0.00019399 | 5.61983468 |
| Lysimachieae | annual | 0.03158252 | 0.00677689 | 2.49E-05 | 5.61532842 |
| Lysimachieae | perennial | 0.02977141 | 0.00677689 | 6.70E-05 | 5.61046734 |
| Onagraceae | annual | 0.03706599 | 1.35863169 | 0.00105959 | 5.61348578 |
| Onagraceae | perennial | 0.00323669 | 1.35863169 | 0.00257146 | 5.6142152 |
| Orobanchaceae | annual | 0.04676778 | 0.50912483 | 0.00084406 | 5.60796797 |
| Orobanchaceae | perennial | 0.04291609 | 0.50912483 | 0.00090528 | 5.60230897 |
| Panicoideae | annual | 0.02590142 | 7.02397466 | 0.00598784 | 5.65319941 |
| Panicoideae | perennial | 0.03932365 | 7.02397466 | 0.00600914 | 5.65127263 |
| Polemoniaceae | annual | 0.01191555 | 0.05554799 | 3.95E-05 | 5.60799034 |
| Polemoniaceae | perennial | 0.0085158 | 0.05554799 | 0.00013439 | 5.6079908 |
| Pooideae | annual | 0.03005168 | 7.02338554 | 0.00461929 | 5.61197783 |
| Pooideae | perennial | 0.02806981 | 7.02338554 | 0.01812177 | 5.58654015 |
| Primulaceae | annual | 0.0225558 | 1.4506934 | 0.00218386 | 5.56845748 |
| Primulaceae | perennial | 0.01196071 | 1.4506934 | 0.0021197 | 5.57852618 |
| Rubieae | annual | 0.03901116 | 9.60836014 | 0.00345269 | 5.61800702 |
| Rubieae | perennial | 0.03892015 | 9.60836014 | 0.01046649 | 5.60194233 |
| Salvia | annual | 0.01855879 | 0.08099552 | 7.45E-05 | 5.62297199 |
| Salvia | perennial | 0.01548408 | 0.08099552 | 7.45E-05 | 5.62271121 |
| Solanaceae | annual | 0.03769563 | 0.10215951 | 0.00014587 | 5.63775801 |
| Solanaceae | perennial | 0.01237181 | 0.10215951 | 0.00014587 | 5.64190815 |
| Spermacoceae | annual | 0.03534535 | 0.13736101 | 0.00015063 | 5.66189236 |
| Spermacoceae | perennial | 0.01316777 | 0.13736101 | 0.00012331 | 5.64154072 |
| Thelypodieae | annual | 0.04237487 | 1.00925814 | 0.00051586 | 5.61278281 |
| Thelypodieae | perennial | 0.07564032 | 1.00925814 | 0.00030275 | 5.59905695 |

**Table S5.** BIO12

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| clade | Group.1 | rate | alpha | sigma.sq | theta |
| Alysseae | annual | 0.04116941 | 0.19036195 | 0.04527165 | 6.24275828 |
| Alysseae | perennial | 0.02025504 | 0.19036195 | 0.03815442 | 6.39814099 |
| Antirrhineae | annual | 0.02919324 | 0.05880125 | 0.04210127 | 6.05373627 |
| Antirrhineae | perennial | 0.01269128 | 0.05880125 | 0.05850862 | 6.18955257 |
| Apioideae | annual | 0.01602982 | 0.11423193 | 0.07621422 | 6.19452692 |
| Apioideae | perennial | 0.0221401 | 0.11423193 | 0.07621422 | 6.46129814 |
| Arabideae | annual | 0.10444553 | 7.3119644 | 4.34841792 | 6.42520345 |
| Arabideae | perennial | 0.14178575 | 7.3119644 | 4.34841442 | 6.43388472 |
| Balsamiaceae | annual | 0.01417992 | 0.01179961 | 0.00842918 | 6.43690021 |
| Balsamiaceae | perennial | 0.01378934 | 0.01179961 | 0.00791053 | 8.34905015 |
| Brassiceae | annual | 0.04707618 | 1.87664502 | 1.39611112 | 6.21384524 |
| Brassiceae | perennial | 0.01834658 | 1.87664502 | 1.38690848 | 6.01805817 |
| Cardamineae | annual | 0.03827605 | 1.29718208 | 0.48138907 | 6.76727827 |
| Cardamineae | perennial | 0.03585023 | 1.29718208 | 0.67981705 | 6.74828047 |
| Cardueae | annual | 0.06688424 | 0.09082574 | 0.02928048 | 6.31051667 |
| Cardueae | perennial | 0.01642933 | 0.09082574 | 0.06484279 | 6.31288359 |
| CES | annual | 0.07955082 | 0.10451031 | 0.15538542 | 5.33390817 |
| CES | perennial | 0.03046781 | 0.10451031 | 0.10954848 | 5.79888036 |
| Chamaecrista | annual | 0.08373911 | 0.05367876 | 0.00196485 | 7.34630367 |
| Chamaecrista | perennial | 0.01153733 | 0.05367876 | 0.01038718 | 7.10679122 |
| Chorisporeae | annual | 0.08350274 | 3.22152374 | 0.79087149 | 5.41609029 |
| Chorisporeae | perennial | 0.09160367 | 3.22152374 | 0.95533864 | 5.65707773 |
| Croton | annual | 0.03687071 | 0.08882436 | 0.25867727 | 6.76402145 |
| Croton | perennial | 0.0058538 | 0.08882436 | 0.03636092 | 7.16056622 |
| Erysimeae | annual | 0.0435169 | 0.62594525 | 0.14738825 | 6.12313936 |
| Erysimeae | perennial | 0.08007439 | 0.62594525 | 0.15498314 | 6.28319991 |
| Euclidieae | annual | 0.03156694 | 0.17283082 | 0.02370745 | 5.39913121 |
| Euclidieae | perennial | 0.04644634 | 0.17283082 | 0.25837963 | 5.45281885 |
| Eumalvoideae | annual | 0.02813053 | 0.05236832 | 0.17352251 | 5.17245971 |
| Eumalvoideae | perennial | 0.01664049 | 0.05236832 | 0.04625187 | 6.60057645 |
| Gesneriaceae | annual | 0.00514178 | 0.02075967 | 0.00419459 | 7.64338703 |
| Gesneriaceae | perennial | 0.00259023 | 0.02075967 | 0.00696187 | 7.37442153 |
| Grewioideae | annual | 0.01851069 | 0.01519887 | 0.01079399 | 6.63883528 |
| Grewioideae | perennial | 0.00204155 | 0.01519887 | 0.01047099 | 7.22264512 |
| Heliophileae | annual | 0.03148566 | 0.18267111 | 0.08926383 | 5.50873313 |
| Heliophileae | perennial | 0.01997662 | 0.18267111 | 0.07281015 | 6.20895515 |
| Hypericum | annual | 0.08474611 | 0.68310322 | 0.17384484 | 7.14698412 |
| Hypericum | perennial | 0.01717609 | 0.68310322 | 0.05788547 | 7.21427088 |
| Lepidieae | annual | 0.22678721 | 4.09428613 | 1.62184764 | 5.98357632 |
| Lepidieae | perennial | 0.21022811 | 4.09428613 | 1.61479762 | 5.97607088 |
| Lupinus | annual | 0.03000707 | 0.03296219 | 0.0470141 | 6.32075538 |
| Lupinus | perennial | 0.07829517 | 0.03296219 | 0.10536494 | 8.20029689 |
| Lysimachieae | annual | 0.03603358 | 0.13033183 | 0.02691997 | 6.9317815 |
| Lysimachieae | perennial | 0.02863371 | 0.13033183 | 0.03122399 | 6.86290627 |
| Onagraceae | annual | 0.0385471 | 0.12746318 | 0.16128676 | 6.10071335 |
| Onagraceae | perennial | 0.00435933 | 0.12746318 | 0.09164123 | 6.8609902 |
| Orobanchaceae | annual | 0.04836983 | 0.04741257 | 0.03653261 | 6.63191087 |
| Orobanchaceae | perennial | 0.04104038 | 0.04741257 | 0.04334687 | 6.44066335 |
| Panicoideae | annual | 0.02649464 | 0.53361681 | 0.26292268 | 6.95358999 |
| Panicoideae | perennial | 0.03891246 | 0.53361681 | 0.26292275 | 6.99399853 |
| Polemoniaceae | annual | 0.01107295 | 0.02045512 | 0.02278383 | 4.33439272 |
| Polemoniaceae | perennial | 0.00787351 | 0.02045512 | 0.02486642 | 6.76427556 |
| Pooideae | annual | 0.0188484 | 8.0067692 | 4.67402096 | 6.28878834 |
| Pooideae | perennial | 0.02946306 | 8.0067692 | 4.68880261 | 6.42808007 |
| Primulaceae | annual | 0.02361879 | 0.38999068 | 0.18046481 | 6.39076673 |
| Primulaceae | perennial | 0.01149745 | 0.38999068 | 0.19282366 | 6.55496722 |
| Rubieae | annual | 0.03459232 | 0.75828112 | 0.04039053 | 6.40171632 |
| Rubieae | perennial | 0.04682316 | 0.75828112 | 0.2410869 | 6.61440928 |
| Salvia | annual | 0.01898019 | 0.05582403 | 0.061728 | 5.3249917 |
| Salvia | perennial | 0.015896 | 0.05582403 | 0.06167412 | 6.36815166 |
| Solanaceae | annual | 0.01401341 | 0.06630001 | 0.15851054 | 5.99752213 |
| Solanaceae | perennial | 0.01109792 | 0.06630001 | 0.15154511 | 6.04384296 |
| Spermacoceae | annual | 0.03530102 | 0.05217572 | 0.02525213 | 7.09950546 |
| Spermacoceae | perennial | 0.01211311 | 0.05217572 | 0.039049 | 6.86151135 |
| Thelypodieae | annual | 0.04425106 | 0.17905675 | 0.21687839 | 6.16657138 |
| Thelypodieae | perennial | 0.07060306 | 0.17905675 | 0.20996241 | 5.93483687 |

**Table S6.** BIO14

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| clade | Group.1 | rate | alpha | sigma.sq | theta |
| Alysseae | annual | 0.04128678 | 0.39587375 | 0.4441553 | 2.35840124 |
| Alysseae | perennial | 0.02371718 | 0.39587375 | 0.44781198 | 2.48680676 |
| Antirrhineae | annual | 0.03145354 | 0.25392107 | 0.51413319 | 1.70130112 |
| Antirrhineae | perennial | 0.01421217 | 0.25392107 | 0.51806035 | 2.14218543 |
| Apioideae | annual | 0.01524207 | 0.12422328 | 0.31137455 | 2.3450107 |
| Apioideae | perennial | 0.02096277 | 0.12422328 | 0.31137456 | 2.28645066 |
| Arabideae | annual | 0.1246393 | 2.50038113 | 4.36494717 | 2.6735432 |
| Arabideae | perennial | 0.14813544 | 2.50038113 | 4.34975364 | 2.69028869 |
| Balsamiaceae | annual | 0.01508213 | 0.07740779 | 0.14151924 | 2.53885605 |
| Balsamiaceae | perennial | 0.01425172 | 0.07740779 | 0.13577727 | 3.25555217 |
| Brassiceae | annual | 0.04329255 | 0.24011376 | 0.46438134 | 2.07425051 |
| Brassiceae | perennial | 0.02385256 | 0.24011376 | 0.47115288 | 1.8322232 |
| Cardamineae | annual | 0.04647318 | 2.30525389 | 1.42219497 | 3.28406468 |
| Cardamineae | perennial | 0.02832631 | 2.30525389 | 4.60777535 | 3.28371196 |
| Cardueae | annual | 0.07434588 | 0.13324756 | 0.26512498 | 2.18891674 |
| Cardueae | perennial | 0.01256012 | 0.13324756 | 0.2651275 | 2.21302382 |
| CES | annual | 0.19864708 | 0.2023053 | 0.25726829 | 2.21535711 |
| CES | perennial | 0.03586053 | 0.2023053 | 0.26335649 | 2.12561137 |
| Chamaecrista | annual | 0.09928236 | 0.07370525 | 0.06941213 | 2.72743857 |
| Chamaecrista | perennial | 0.01049807 | 0.07370525 | 0.10452338 | 2.75579867 |
| Chorisporeae | annual | 0.08930619 | 5.04648042 | 4.84786201 | 1.85570731 |
| Chorisporeae | perennial | 0.09086837 | 5.04648042 | 4.90602539 | 2.01469117 |
| Croton | annual | 0.02965713 | 0.13331075 | 0.26503343 | 3.11749788 |
| Croton | perennial | 0.00576384 | 0.13331075 | 0.26503813 | 3.00631608 |
| Erysimeae | annual | 0.05617456 | 0.90560808 | 1.63570551 | 2.34096316 |
| Erysimeae | perennial | 0.05681704 | 0.90560808 | 1.64801392 | 2.07878073 |
| Euclidieae | annual | 0.03052756 | 0.17899059 | 0.15139652 | 1.1490183 |
| Euclidieae | perennial | 0.04908825 | 0.17899059 | 0.41589176 | 1.45295695 |
| Eumalvoideae | annual | 0.03055092 | 0.06645048 | 0.13627013 | 1.23769843 |
| Eumalvoideae | perennial | 0.01301408 | 0.06645048 | 0.13627068 | 2.19076227 |
| Gesneriaceae | annual | 0.00960378 | 0.02763987 | 0.05832076 | 3.34129952 |
| Gesneriaceae | perennial | 0.00248544 | 0.02763987 | 0.05812546 | 3.33565852 |
| Grewioideae | annual | 0.02246705 | 0.05825947 | 0.11657273 | 2.0061262 |
| Grewioideae | perennial | 0.00299285 | 0.05825947 | 0.11656734 | 2.98738402 |
| Heliophileae | annual | 0.03505583 | 0.04611129 | 0.05166065 | 1.97158873 |
| Heliophileae | perennial | 0.01952112 | 0.04611129 | 0.04293603 | 3.03400287 |
| Hypericum | annual | 0.09775582 | 0.70354441 | 0.88301032 | 3.30162956 |
| Hypericum | perennial | 0.01262613 | 0.70354441 | 0.0737134 | 4.08757487 |
| Lepidieae | annual | 0.24148401 | 1.4627211 | 2.84283768 | 2.08167002 |
| Lepidieae | perennial | 0.20250524 | 1.4627211 | 2.46772765 | 2.06101929 |
| Lupinus | annual | 0.0299301 | 0.00045008 | 0.11232501 | 2.04600881 |
| Lupinus | perennial | 0.06609475 | 0.00045008 | 0.43654883 | 2.04027876 |
| Lysimachieae | annual | 0.04000742 | 0.32148745 | 0.33002989 | 2.79958746 |
| Lysimachieae | perennial | 0.02904615 | 0.32148745 | 0.33010595 | 3.00227727 |
| Onagraceae | annual | 1.47718469 | 0.26326998 | 0.45818026 | 1.94290395 |
| Onagraceae | perennial | 1.66286254 | 0.26326998 | 0.69082882 | 2.91186965 |
| Orobanchaceae | annual | 0.04082546 | 0.9540879 | 2.15192758 | 2.57300925 |
| Orobanchaceae | perennial | 0.04470213 | 0.9540879 | 2.21659985 | 2.57171532 |
| Panicoideae | annual | 0.01888656 | 1.29897197 | 2.23586442 | 2.28973178 |
| Panicoideae | perennial | 0.04030941 | 1.29897197 | 2.23586442 | 2.7961387 |
| Polemoniaceae | annual | 0.0132323 | 0.07515773 | 0.10438561 | 1.48991147 |
| Polemoniaceae | perennial | 0.01012157 | 0.07515773 | 0.15057698 | 2.58427997 |
| Pooideae | annual | 0.02001605 | 0.93384385 | 1.81217652 | 2.18967575 |
| Pooideae | perennial | 0.02696252 | 0.93384385 | 1.8121767 | 2.76232292 |
| Primulaceae | annual | 0.02057645 | 0.17474529 | 0.46749182 | 2.20033062 |
| Primulaceae | perennial | 0.01156039 | 0.17474529 | 0.46749183 | 2.24246698 |
| Rubieae | annual | 0.11367892 | 1.244906 | 2.31498746 | 2.20696365 |
| Rubieae | perennial | 0.03310733 | 1.244906 | 2.37652947 | 2.70892502 |
| Salvia | annual | 0.01870823 | 0.07861361 | 0.16211643 | 1.79452442 |
| Salvia | perennial | 0.0155215 | 0.07861361 | 0.162119 | 2.04769413 |
| Solanaceae | annual | 0.01715148 | 0.17187496 | 0.34899588 | 1.74133921 |
| Solanaceae | perennial | 0.01330192 | 0.17187496 | 0.34899592 | 2.87471849 |
| Spermacoceae | annual | 0.03407916 | 0.03791588 | 0.10042255 | 2.40158345 |
| Spermacoceae | perennial | 0.01287896 | 0.03791588 | 0.10057995 | 2.52361849 |
| Thelypodieae | annual | 0.05653152 | 0.02218699 | 0.19335883 | 1.40802748 |
| Thelypodieae | perennial | 0.05639596 | 0.02218699 | 0.06639772 | 0.99389082 |

Table S7. BIO15

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| clade | Group.1 | rate | alpha | sigma.sq | theta |
| Alysseae | annual | 0.04155405 | 6.76094614 | 1.38224676 | 3.79661529 |
| Alysseae | perennial | 0.02486197 | 6.76094614 | 1.37899295 | 3.79316364 |
| Antirrhineae | annual | 0.02871898 | 0.18997829 | 0.0699409 | 3.93790739 |
| Antirrhineae | perennial | 0.0121807 | 0.18997829 | 0.07433216 | 3.95943992 |
| Apioideae | annual | 0.05266043 | 0.09778867 | 0.04944416 | 3.85233249 |
| Apioideae | perennial | 0.00934632 | 0.09778867 | 0.05590919 | 3.89088209 |
| Arabideae | annual | 0.13736519 | 5.98079291 | 2.28870901 | 3.79356842 |
| Arabideae | perennial | 0.13691382 | 5.98079291 | 2.18669782 | 3.82285345 |
| Balsamiaceae | annual | 0.01423208 | 0.04892724 | 0.01477393 | 4.13217229 |
| Balsamiaceae | perennial | 0.01342129 | 0.04892724 | 0.01544012 | 4.06214418 |
| Brassiceae | annual | 0.0452066 | 0.78788956 | 0.41823176 | 3.83045967 |
| Brassiceae | perennial | 0.01679124 | 0.78788956 | 0.34660596 | 3.86681622 |
| Cardamineae | annual | 0.05609979 | 0.34653582 | 0.08432257 | 3.53490268 |
| Cardamineae | perennial | 0.03290568 | 0.34653582 | 0.22058434 | 3.60329065 |
| Cardueae | annual | 0.05763683 | 0.2244015 | 0.05683454 | 3.8804587 |
| Cardueae | perennial | 0.03353348 | 0.2244015 | 0.05817862 | 3.90034307 |
| CES | annual | 0.07679611 | 0.00798582 | 0.00979194 | 4.06059801 |
| CES | perennial | 0.03143227 | 0.00798582 | 0.02070469 | 3.9313969 |
| Chamaecrista | annual | 0.0884329 | 0.00586828 | 0.00622706 | 4.14633571 |
| Chamaecrista | perennial | 0.01161986 | 0.00586828 | 0.00543901 | 3.90529362 |
| Chorisporeae | annual | 0.06861689 | 0.49866028 | 0.1389933 | 4.02607213 |
| Chorisporeae | perennial | 0.08217822 | 0.49866028 | 0.17045693 | 3.98113444 |
| Croton | annual | 0.01827458 | 0.18210444 | 0.05639281 | 3.41900189 |
| Croton | perennial | 0.00489446 | 0.18210444 | 0.05626612 | 4.06993011 |
| Erysimeae | annual | 0.05877242 | 0.51344609 | 0.24097373 | 3.77932462 |
| Erysimeae | perennial | 0.06446853 | 0.51344609 | 0.15767626 | 4.04711484 |
| Euclidieae | annual | 0.03326008 | 0.24037128 | 0.08779928 | 4.14366647 |
| Euclidieae | perennial | 0.04482494 | 0.24037128 | 0.13181966 | 4.12335769 |
| Eumalvoideae | annual | 0.03993844 | 0.0764752 | 0.00729255 | 4.22932158 |
| Eumalvoideae | perennial | 0.01353152 | 0.0764752 | 0.02191895 | 4.21162143 |
| Gesneriaceae | annual | 0.00385405 | 0.04958787 | 0.01776767 | 4.00122058 |
| Gesneriaceae | perennial | 0.00260615 | 0.04958787 | 0.01772866 | 4.00082011 |
| Grewioideae | annual | 0.02103246 | 0.07945596 | 0.00708682 | 4.39063068 |
| Grewioideae | perennial | 0.00164885 | 0.07945596 | 0.02138871 | 4.01319547 |
| Heliophileae | annual | 0.03635766 | 0.23313833 | 0.01802255 | 3.82037234 |
| Heliophileae | perennial | 0.02558159 | 0.23313833 | 0.05086611 | 3.80351134 |
| Hypericum | annual | 0.0993899 | 0.29426783 | 0.17792348 | 3.41088445 |
| Hypericum | perennial | 0.01401524 | 0.29426783 | 0.05157863 | 3.23368566 |
| Lepidieae | annual | 0.22685506 | 1.81377752 | 0.84738575 | 3.86200635 |
| Lepidieae | perennial | 0.20373133 | 1.81377752 | 0.8292531 | 3.82621227 |
| Lupinus | annual | 0.02919639 | 0.03739374 | 0.02477043 | 3.9796499 |
| Lupinus | perennial | 0.07787184 | 0.03739374 | 0.1085328 | 3.24632011 |
| Lysimachieae | annual | 0.03717362 | 0.11835388 | 0.00848736 | 4.00125334 |
| Lysimachieae | perennial | 0.0281207 | 0.11835388 | 0.0507377 | 3.82533477 |
| Onagraceae | annual | 0.03837558 | 0.66114535 | 0.43469802 | 4.00959811 |
| Onagraceae | perennial | 0.0045882 | 0.66114535 | 0.43503327 | 3.81326747 |
| Orobanchaceae | annual | 0.04441356 | 0.36790357 | 0.19490971 | 3.83165369 |
| Orobanchaceae | perennial | 0.04145397 | 0.36790357 | 0.19944175 | 3.88496486 |
| Panicoideae | annual | 0.02800291 | 9.99992238 | 3.4084159 | 4.18741051 |
| Panicoideae | perennial | 0.04026629 | 9.99992238 | 3.408369 | 3.99529444 |
| Polemoniaceae | annual | 0.0115838 | 0.07434326 | 0.01963483 | 3.97675337 |
| Polemoniaceae | perennial | 0.00885962 | 0.07434326 | 0.0531946 | 3.97746893 |
| Pooideae | annual | 0.02522916 | 8.71583652 | 4.21029626 | 3.84098247 |
| Pooideae | perennial | 0.0311285 | 8.71583652 | 4.21029627 | 3.66684044 |
| Primulaceae | annual | 0.02314268 | 0.12321535 | 0.06162424 | 4.05960667 |
| Primulaceae | perennial | 0.01178813 | 0.12321535 | 0.06479303 | 4.07902527 |
| Rubieae | annual | 0.10892769 | 0.78391979 | 0.25530172 | 3.85143834 |
| Rubieae | perennial | 0.02367202 | 0.78391979 | 0.33716985 | 3.82713992 |
| Salvia | annual | 0.01700832 | 0.09567735 | 0.01553976 | 4.19909233 |
| Salvia | perennial | 0.0150281 | 0.09567735 | 0.03452563 | 4.1760563 |
| Solanaceae | annual | 0.03925798 | 0.20868257 | 0.08293553 | 4.12002722 |
| Solanaceae | perennial | 0.01441309 | 0.20868257 | 0.08113076 | 4.0231765 |
| Spermacoceae | annual | 0.03412617 | 0.05841163 | 0.02295724 | 4.22272915 |
| Spermacoceae | perennial | 0.01240046 | 0.05841163 | 0.02422034 | 4.11327556 |
| Thelypodieae | annual | 0.04313355 | 0.03939268 | 0.0394036 | 4.09556299 |
| Thelypodieae | perennial | 0.07203443 | 0.03939268 | 0.0375932 | 4.12090552 |

**Table S8.** AI

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| clade | Group.1 | rate | alpha | sigma.sq | theta |
| Alysseae | annual | 0.04030233 | 0.34853482 | 0.16651319 | 8.23596117 |
| Alysseae | perennial | 0.02424038 | 0.34853482 | 0.20031482 | 8.33323375 |
| Antirrhineae | annual | 0.02992664 | 0.05268783 | 0.0665517 | 7.83521596 |
| Antirrhineae | perennial | 0.01289018 | 0.05268783 | 0.08899283 | 7.91692405 |
| Apioideae | annual | 0.02107216 | 0.07106027 | 0.0799759 | 8.13484316 |
| Apioideae | perennial | 0.01946203 | 0.07106027 | 0.0799759 | 8.67364721 |
| Arabideae | annual | 0.09698462 | 10 | 5.48687265 | 8.71047719 |
| Arabideae | perennial | 0.13109321 | 10 | 5.48687265 | 8.82531687 |
| Balsamiaceae | annual | 0.01416107 | 4.68829094 | 1.15412892 | 9.12859414 |
| Balsamiaceae | perennial | 0.01232552 | 4.68829094 | 1.15506067 | 9.45715807 |
| Brassiceae | annual | 0.04485486 | 2.05732314 | 2.67691747 | 8.1041908 |
| Brassiceae | perennial | 0.01930118 | 2.05732314 | 2.66802778 | 7.91405884 |
| Cardamineae | annual | 0.05377465 | 6.8854024 | 2.23948173 | 8.98243888 |
| Cardamineae | perennial | 0.03299381 | 6.8854024 | 2.23158769 | 9.13251343 |
| Cardueae | annual | 0.05541007 | 0.13570678 | 0.10129996 | 8.147476 |
| Cardueae | perennial | 0.02616704 | 0.13570678 | 0.1178579 | 8.50145217 |
| CES | annual | 0.0852525 | 0.25268969 | 0.4753827 | 7.50996351 |
| CES | perennial | 0.03088316 | 0.25268969 | 0.13867862 | 7.91360517 |
| Chamaecrista | annual | 0.08469111 | 0.00953602 | 0.00697957 | 9.03197266 |
| Chamaecrista | perennial | 0.01153876 | 0.00953602 | 0.00673797 | 9.03932254 |
| Chorisporeae | annual | 0.08161394 | 0.2744213 | 0.01678788 | 7.04724848 |
| Chorisporeae | perennial | 0.10328263 | 0.2744213 | 0.13663049 | 8.83609909 |
| Croton | annual | 0.03415848 | 0.0692009 | 0.41526537 | 8.93385665 |
| Croton | perennial | 0.00640381 | 0.0692009 | 0.03627557 | 8.9338686 |
| Erysimeae | annual | 0.06030963 | 0.71632778 | 0.35194845 | 8.22615218 |
| Erysimeae | perennial | 0.06051128 | 0.71632778 | 0.34481591 | 8.27159025 |
| Euclidieae | annual | 0.03019637 | 0.50928631 | 0.17665409 | 7.25212009 |
| Euclidieae | perennial | 0.05275321 | 0.50928631 | 0.48401792 | 8.24217854 |
| Eumalvoideae | annual | 0.0409016 | 0.04877877 | 0.09335003 | 7.18902524 |
| Eumalvoideae | perennial | 0.01614903 | 0.04877877 | 0.09015431 | 8.28117526 |
| Gesneriaceae | annual | 0.00387631 | 0.04328585 | 0.01111532 | 9.43186045 |
| Gesneriaceae | perennial | 0.00229391 | 0.04328585 | 0.01121134 | 9.3856122 |
| Grewioideae | annual | 0.01734095 | 0.02189404 | 0.02827933 | 8.30361448 |
| Grewioideae | perennial | 0.00186462 | 0.02189404 | 0.0181696 | 9.04959079 |
| Heliophileae | annual | 0.06634313 | 0.13605649 | 0.08969506 | 6.97503679 |
| Heliophileae | perennial | 0.10404222 | 0.13605649 | 0.06252826 | 8.39869433 |
| Hypericum | annual | 0.08162554 | 0.59004273 | 0.35475392 | 9.12085686 |
| Hypericum | perennial | 0.01643431 | 0.59004273 | 0.02609249 | 9.16897766 |
| Lepidieae | annual | 0.24377528 | 9.48539121 | 7.81624215 | 7.77321372 |
| Lepidieae | perennial | 0.20901694 | 9.48539121 | 7.77153297 | 7.77984526 |
| Lupinus | annual | 0.02805195 | 0.0327964 | 0.08562482 | 8.1163569 |
| Lupinus | perennial | 0.07866818 | 0.0327964 | 0.11880514 | 13.6381535 |
| Lysimachieae | annual | 0.03774993 | 0.11544436 | 0.02712105 | 8.88684662 |
| Lysimachieae | perennial | 0.02849096 | 0.11544436 | 0.02389185 | 8.99585704 |
| Onagraceae | annual | 0.03871019 | 0.10943066 | 0.27245281 | 7.89504685 |
| Onagraceae | perennial | 0.00416502 | 0.10943066 | 0.07267066 | 8.85193465 |
| Orobanchaceae | annual | 0.04398991 | 0.15740082 | 0.1580424 | 8.5411767 |
| Orobanchaceae | perennial | 0.04174612 | 0.15740082 | 0.15936042 | 8.48590867 |
| Panicoideae | annual | 0.02815515 | 0.81789315 | 0.65324868 | 8.66344107 |
| Panicoideae | perennial | 0.03949567 | 0.81789315 | 0.65324854 | 8.78505209 |
| Polemoniaceae | annual | 0.01167735 | 0.03361776 | 0.03668367 | 7.38397126 |
| Polemoniaceae | perennial | 0.00838739 | 0.03361776 | 0.03667393 | 9.26525933 |
| Pooideae | annual | 0.0270249 | 2.41066525 | 1.94154524 | 8.26179387 |
| Pooideae | perennial | 0.03013477 | 2.41066525 | 1.94154524 | 8.69603936 |
| Primulaceae | annual | 0.0251974 | 0.2483582 | 0.11808828 | 8.75717914 |
| Primulaceae | perennial | 0.01151704 | 0.2483582 | 0.15285536 | 8.85551769 |
| Rubieae | annual | 0.04169511 | 1.18607452 | 0.15363439 | 8.35687711 |
| Rubieae | perennial | 0.04908283 | 1.18607452 | 0.55882939 | 8.7696908 |
| Salvia | annual | 0.01577602 | 0.05665405 | 0.07639197 | 7.61132764 |
| Salvia | perennial | 0.015253 | 0.05665405 | 0.07636625 | 8.19096074 |
| Solanaceae | annual | 0.02411958 | 0.12608527 | 0.31342469 | 7.88138697 |
| Solanaceae | perennial | 0.014473 | 0.12608527 | 0.23621796 | 8.45916171 |
| Spermacoceae | annual | 0.03479382 | 0.03536571 | 0.03113017 | 8.84366586 |
| Spermacoceae | perennial | 0.01199718 | 0.03536571 | 0.03419885 | 8.69948668 |
| Thelypodieae | annual | 0.04566576 | 0.02670115 | 0.10177345 | 7.87572838 |
| Thelypodieae | perennial | 0.07724747 | 0.02670115 | 0.09840788 | 7.48079913 |