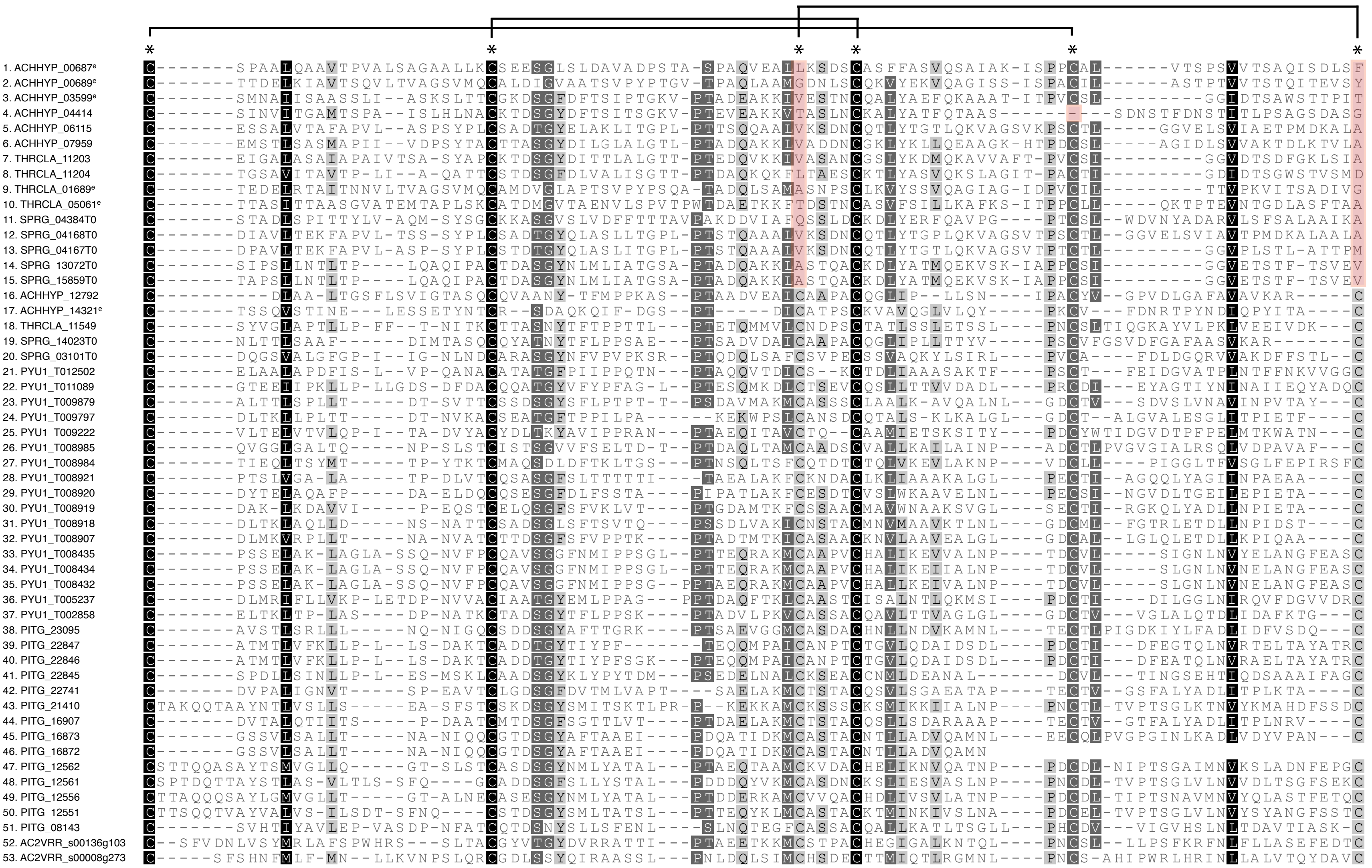

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1. ACHHYP_00687[e]      C-------SPAALQAAVTPVALSAGAALLKCSEESGLSLDAVADPSTA-SPAQVEALLKSDSCASFFASVQSAIAK-ISPPCAL------VTSPSVVTSAQISDLSF
2. ACHHYP_00689[e]      C-------TTDELKIAVTSQVLTVAGSVMQCALDIGVAATSVPYPTGV-TPAQLAAMGDNLSCQKVYEKVQAGISS-ISPACIL------ASTPTVVTSTQITEVSY
3. ACHHYP_03599[e]      C-------SMNAIISAASSLI--ASKSLTTCGKDSGFDFTSIPTGKV-PTADEAKKIVESTNCQALYAEFQKAAAT-ITPVCSL---------GGIDTSAWSTTPIT
4. ACHHYP_04414         C-------SINVITGAMTSPA--ISLHLNACKTDSGYDFTSITSGKV-PTEVEAKKVTASLNCKALYATFQTAAS----------SDNSTFDNSTITLPSAGSDASG
5. ACHHYP_06115         C-------ESSALVTAFAPVL--ASPSYPLCSADTGYELAKLITGPL-PTTSQQAALVKSDNCQTLYTGTLQKVAGSVKPSCTL-----GGVELSVIAETPMDKALA
6. ACHHYP_07959         C-------EMSTLSASMAPII--VDPSYTACTTASGYDILGLALGTL-PTADQAKKLVADDNCGKLYKLLQEAAGK-HTPDCSL-----AGIDLSVVAKTDLKTVLA
7. THRCLA_11203         C-------EIGALASAIAPAIVTSA-SYAPCKTDSGYDITTLALGTT-PTEDQVKKIVASANCGSLYKDMQKAVVAFT-PVCSI---------GGVDTSDFGKLSIA
8. THRCLA_11204         C-------TGSAVITAVTP-LI--A-QATTCSTDSGFDLVALISGTT-PTDAQKQKFLTAESCKTLYASVQKSLAGIT-PACTI---------GDIDTSGWSTVSMD
9. THRCLA_01689[e]      C-------TEDELRTAITNNVLTVAGSVMQCAMDVGLAPTSVPYPSQA-TADQLSAMASNPSCLKVYSSVQAGIAG-IDPVCIL---------TTVPKVITSADIVG
10. THRCLA_05061[e]     C-------TTASITTAASGVATEMTAPLSKCATDMGVTAENVLSPVTPWTDAETKKFTDSTNCASVFSILLKAFKS-ITPPCLL-----QKTPTEVNTGDLASFTAA
11. SPRG_04384T0        C-------STADLSPITTYLV-AQM-SYSGCKKASGVSLVDFFTTTAVPAKDDVIAFQSSLDCKDLYERFQAVPG----PTCSL--WDVNYADARVLSFSALAAIKA
12. SPRG_04168T0        C-------DIAVLTEKFAPVL-TSS-SYPLCSADTGYQLASLLTGPL-PTSTQAAALVKSDNCQTLYTGPLQKVAGSVTPSCTL--GGVELSVIAVTPMDKALAALA
13. SPRG_04167T0        C-------DPAVLTEKFAPVL-ASP-SYPLCSTDTGYQLASLITGPL-PTSTQAAALVKSDNCQTLYTGTLQKVAGSVTPTCTL---------GGVPLSTL-ATTPM
14. SPRG_13072T0        C-------SIPSLLNTLTP----LQAQIPACTDASGYNLMLIATGSA-PTADQAKKLASTQACKDLYATMQEKVSK-IAPPCSI---------GGVETSTF-TSVEV
15. SPRG_15859T0        C-------TAPSLLNTLTP----LQAQIPACTDASGYNLMLIATGSA-PTADQAKKLASTQACKDLYATMQEKVSK-IAPPCSI---------GGVETSTF-TSVEV
16. ACHHYP_12792        C----------DLAA-LTGSFLSVIGTASQCQVAANY-TFMPPKAS--PTAADVEAICAAPACQGLIP--LLSN----IPACYV--GPVDLGAFAVAVKAR-----C
17. ACHHYP_14321[e]     C-------TSSQVSTINE---LESSETYNTCR--SDAQKQIF-DGS--PT-----DICATPSCKVAVQGLVLQY-----PKCV---FDNRTPYNDIQPYITA----C
18. THRCLA_11549        C-------SYVGLAPTLLP-FF--T-NITKCTTASNYTFTPPTTL---PTETQMMVLCNDPSCTATLSSLETSSL----PNCSLTIQGKAYVLPKLVEEIVDK---C
19. SPRG_14023T0        C-------NLTTLSAAF------DIMTASQCQYATNYTFLPPSAE---PTSADVDAICAAPACQGLIPLLTTYV-----PSCVFGSVDFGAFAASVKAR-------C
20. SPRG_03101T0        C-------DQGSVALGFGP-I--IG-NLNDCARASGYNFVPVPKSR--PTQDQLSAFCSVPECSSVAQKYLSIRL----PVCA----FDLDGQRVVAKDFFSTL--C
21. PYU1_T012502        C-------ELAALAPDFIS-L--VP-QANACATATGFPIIPPQTN---PTAQQVTDICS--KCTDLIAAASAKTF----PSCT---FEIDGVATPLNTFFNKVVGGC
22. PYU1_T011089        C-------GTEEIIPKLLP-LLGDS-DFDACQQATGYVFYPFAG-L--PTESQMKDLCTSEVCQSLLTTVVDADL----PRCDI---EYAGTIYNINAIIEQYADQC
23. PYU1_T009879        C-------ALTTLSPLLT-----DT-SVTTCSSDSGYSFLPTPT-T--PSDAVMAKMCASSSCLAALK-AVQALNL---GDCTV---SDVSLVNAVINPVTAY---C
24. PYU1_T009797        C-------DLTKLLPLTT-----DT-NVKACSEATGFTPPILPA------KEKWPSLCANSDCQTALS-KLKALGL---GDCT--ALGVALESGLITPIETF----C
25. PYU1_T009222        C-------VLTELVTVLQP-I--TA-DVYACYDLTKYAVIPPRAN---PTAEQITAVCTQ--CAAMIETSKSITY----PDCYWTIDGVDTPFPELMTKWATN---C
26. PYU1_T008985        C-------QVGGLGALTQ-----NP-SLSTCISTSGVVFSELTD-T--PTDAQLTAMCAADSCVALLKAILAINP----ADCTLPVGVGIALRSQLVDPAVAF---C
27. PYU1_T008984        C-------TIEQLTSYMT-----TP-YTKTCMAQSDLDFTKLTGS---PTNSQLTSFCQTDTCTQLVKEVLAKNP----VDCLL----PIGGLTFVSGLFEPIRSFC
28. PYU1_T008921        C-------PTSLVGA-LA-----TP-DLVTCQSASGFSLTTTTTI----TAEALAKFCKNDACLKLIAAAKALGL----PECTI--AGQQLYAGIINPAEAA----C
29. PYU1_T008920        C-------DYTELAQAFP-----DA-ELDQCQSESGFDLFSSTA----PIPATLAKFCESDTCVSLWKAAVELNL----PECSI--NGVDLTGEILEPIETA----C
30. PYU1_T008919        C-------DAK-LKDAVVI-----P-EQSTCELQSGFSFVKLVT----PTGDAMTKFCSSAACMAVWNAAKSVGL----SECTI--RGKQLYADLLNPIETA----C
31. PYU1_T008918        C-------DLTKLAQLLD-----NS-NATTCSADSGLSFTSVTQ----PSSDLVAKICNSTACMNVMAAVKTLNL----GDCML--FGTRLETDLLNPIDST----C
32. PYU1_T008907        C-------DLMKVRPLLT-----NA-NVATCTTDSGFSFVPPTK----PTADTMTKICASAACKNVLAAVEALGL----GDCAL--LGLQLETDLLKPIQAA----C
33. PYU1_T008435        C-------PSSELAK-LAGLA-SSQ-NVFPCQAVSGGFNMIPPSGL--PTTEQRAKMCAAPVCHALIKEVVALNP----TDCVL-----SIGNLNVYELANGFEASC
34. PYU1_T008434        C-------PSSELAK-LAGLA-SSQ-NVFPCQAVSGGFNMIPPSGL--PTTEQRAKMCAAPVCHALIKEIIALNP----TDCVL-----SLGNLNVNELANGFEASC
35. PYU1_T008432        C-------PSSELAK-LAGLA-SSQ-NVFPCQAVSGGFNMIPPSG--PPTAEQRAKMCAAPVCHALLKEIVALNP----TDCVL-----SLGNLNVNELANGFEASC
36. PYU1_T005237        C-------DLMRIFLLVKP-LETDP-NVVACIAATGYEMLPPAG---PPTDAQFTKLCAASTCISALNTLQKMSI----PDCTI----DILGGLNIRQVFDGVVDRC
37. PYU1_T002858        C-------ELTKLTP-LAS----DP-NATKCTADSGYTFLPPSK----PTADVLPKVCASSACQAVLTTVAGLGL----GDCTV---VGLAQTDLIDAFKTG---C
38. PITG_23095          C-------AVSTLSRLLL-----NQ-NIGQCSDDSGYAFTTGRK----PTSAEVGGMCASDACHNLLNDVKAMNL----TECTLPIGDKIYLFADLIDFVSDQ---C
39. PITG_22847          C-------ATMTLVFKLLP-L--LS-DAKTCADDTGYTIYPF-------TEQQMPAICANPTCTGVLQDAIDSDL----PDCTI---DFEGTQLNVRTELTAYATRC
40. PITG_22846          C-------ATMTLVFKLLP-L--LS-DAKTCADDTGYTIYPFSGK---PTEQQMPAICANPTCTGVLQDAIDSDL----PDCTI---DFEATQLNVRAELTAYATRC
41. PITG_22845          C-------SPDLLSINLLP-L--ES-MSKLCAADSGYKLYPYTDM---PSEDELNALCKSEACCNMLDEANAL-------DCVL---TINGSEHTIQDSAAAIFAGC
42. PITG_22741          C-------DVPALIGNVT-----SP-EAVTCLGDSGFDVTMLVAPT----SAELAKMCTSTACQSVLSGAEATAP----TECTV--GSFALYADLITPLKTA----C
43. PITG_21410          CTAKQQTAAYNTLVSLLS-----EA-SFSTCSKDSGYSMITSKTLPR-P--KEKKAMCKSSSCKSMIKKIIALNP----PNCTL-TVPTSGLKTNVYKMAHDFSSDC
44. PITG_16907          C-------DVTALQTIITS-----P-DAATCMTDSGFSGTTLVT----PTDAELAKMCTSTACQSLLSDARAAAP----TECTV--GTFALYADLITPLNRV----C
45. PITG_16873          C-------GSSVLSALLT-----NA-NIQQCGTDSGYAFTAAEI----PDQATIDKMCASTACNTLLADVQAMNL----EECQLPVGPGINLKADLVDYVPAN---C
46. PITG_16872          C-------GSSVLSALLT-----NA-NIQQCGTDSGYAFTAAEI----PDQATIDKMCASTACNTLLADVQAMN
47. PITG_12562          CSTTQQASAYTSMVGLLQ-----GT-SLSTCASDSGYNMLYATAL---PTAEQTAAMCKVDACHELIKNVQATNP----PDCDL-NIPTSGAIMNVKSLADNFEPGC
48. PITG_12561          CSPTDQTTAYSTLAS-VLTLS-SFQ----GCADDSGFSLLYSTAL---PDDDQYVKMCASDNCKSLIESVASLNP----PNCDL-TVPTSGLVLNVVDLTSGFSEKC
49. PITG_12556          CTTAQQQSAYLGMVGLLT-----GT-ALNECASESGYNMLYATAL---PTDDERKAMCVVQACHDLIVSVLATNP----PDCDL-TIPTSNAVMNVYQLASTFETQC
50. PITG_12551          CTTSQQTVAYVALVS-ILSDT-SFNQ----CSTDSGYSMLTATSL---PTTEQYKLMCASTACKTMINKIVSLNA----PDCEL-TVPTSGLVLNVYSYANGFSSTC
51. PITG_08143          C-------SVHTIYAVLEP-VASDP-NFATCQTDSNYSLLSFENL----SLNQTEGFCASSACQALLKATLTSGLL---PHCDV---VIGVHSLNLTDAVTIASK-C
52. AC2VRR_s00136g103   C--SFVDNLVSYMRLAFSPWHRS---SLTACGYVTGYDVRRATTI---PTAEETKKMCSTPACHEGIGALKNTQL----PNCSL--LLPSFKRFNLFLLASEFEDTC
53. AC2VRR_s00008g273   C-----SFSHNFMLF-MN--LLKVNPSLQRCGDLSSYQIRAASSL---PNLDQLSIMCHSDECTTMIQTLRGMNL----PNCS-AHIPWRLHRINLLALVTQYDAVC
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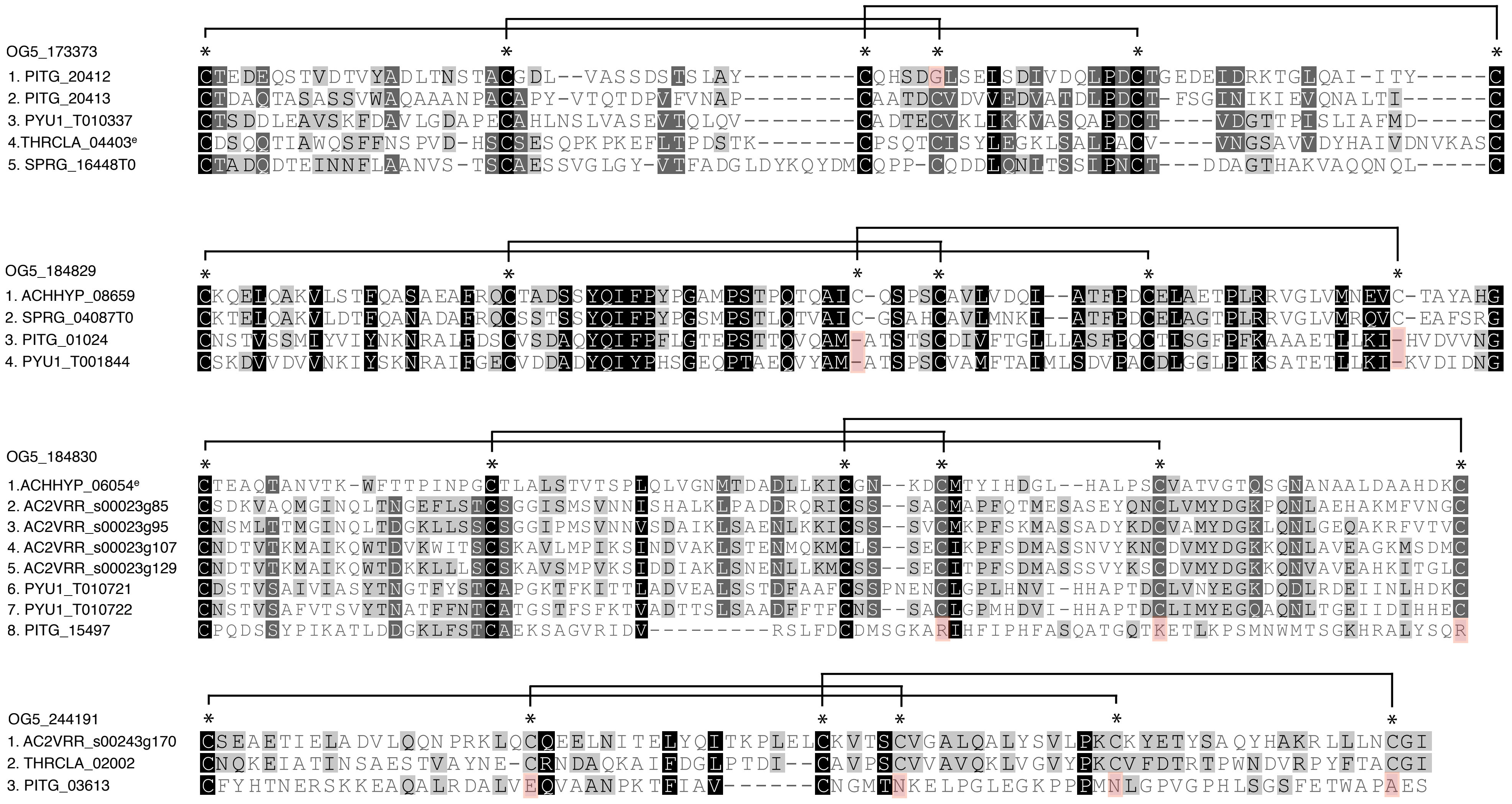
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2. PITG_20413 CTDAQTASASSVWAQAAANPACAPY-VTQTDPVFVNAP--------CAATDCVDVVEDVATDLPDCT-FSGINIKIEVQNALTI------C
3. PYU1_T010337 CTSDDLEAVSKFDAVLGDAPECAHLNSLVASEVTQLQV--------CADTECVKLIKKVASQAPDCT----VDGTTPISLIAFMD-----C
4.THRCLA_04403^{e} CDSQQTIAWQSFFNSPVD-HSCSESQPKPKEFLTPDSTK-------CPSQTCISYLEGKLSALPACV----VNGSAVVDYHAIVDNVKASC
5. SPRG_16448T0 CTADQDTEINNFLAANVS-TSCAESSVGLGY-VTFADGLDYKQYDMCQPP-CQDDLQNLTSSIPNCT---DDAGTHAKVAQQNQL-----C
OG5_184829
1. ACHHYP_08659 CKQELQAKVLSTFQASAEAFRQCTADSSYQIFPYPGAMPSTPQTQAIC-QSPSCAVLVDQI--ATFPDCELAETPLRRVGLVMNEVC-TAYAHG
2. SPRG_04087T0 CKTELQAKVLDTFQANADAFRQCSSTSSYQIFPYPGSMPSTLQTVAIC-GSAHCAVLMNKI--ATFPDCELAGTPLRRVGLVMRQVC-EAFSRG
3. PITG_01024 CNSTVSSMIYVIYNKNRALFDSCVSDAQYQIFPFLGTEPSTTQVQAM-ATSTSCDIVFTGLLLASFPQCTISGFPFKAAAETLLKI-HVDVVNG
4. PYU1_T001844 CSKDVVDVVNKIYSKNRAIFGECVDDADYQIYPHSGEQPTAEQVYAM-ATSPSCVAMFTAIMLSDVPACDLGGLPIKSATETLLKI-KVDIDNG
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2. AC2VRR_s00023g85 CSDKVAQMGINQLTNGEFLSTCSGGISMSVNNISHALKLPADDRQRICSS--SACMAPFQTMESASEYQNCLVMYDGKPQNLAEHAKMFVNGC
3. AC2VRR_s00023g95 CNSMLTTMGINQLTDGKLLSSCSGGIPMSVNNVSDAIKLSAENLKKICSS--SVCMKPFSKMASSADYKDCVAMYDGKLQNLGEQAKRFVTVC
4. AC2VRR_s00023g107 CNDTVTKMAIKQWTDVKWITSCSKAVLMPIKSINDVAKLSTENMQKMCLS--SECIKPFSDMASSNVYKNCDVMYDGKKQNLAVEAGKMSDMC
5. AC2VRR_s00023g129 CNDTVTKMAIKQWTDKKLLLSCSKAVSMPVKSIDDIAKLSNENLLKMCSS--SECITPFSDMASSSVYKSCDVMYDGKKQNVAVEAHKITGLC
6. PYU1_T010721 CDSTVSAIVIASYTNGTFYSTCAPGKTFKITTLADVEALSSTDFAAFCSSPNENCLGPLHNVI-HHAPTDCLVNYEGKDQDLRDEIINLHDKC
7. PYU1_T010722 CNSTVSAFVTSVYTNATFFNTCATGSTFSFKTVADTTSLSAADFFTFCNS--SACLGPMHDVI-HHAPTDCLIMYEGQAQNLTGEIIDIHHEC
8. PITG_15497 CPQDSSYPIKATLDDGKLFSTCAEKSAGVRIDV---------RSLFDCDMSGKARIHFIPHFASQATGQTKETLKPSMNWMTSGKHRALYSQR
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1. AC2VRR_s00243g170 CSEAETIELADVLQQNPRKLQCQEELNITELYQITKPLELCKVTSCVGALQALYSVLPKCKYETYSAQYHAKRLLLNCGI
2. THRCLA_02002 CNQKEIATINSAESTVAYNE-CRNDAQKAIFDGLPTDI--CAVPSCVVAVQKLVGVYPKCVFDTRTPWNDVRPYFTACGI
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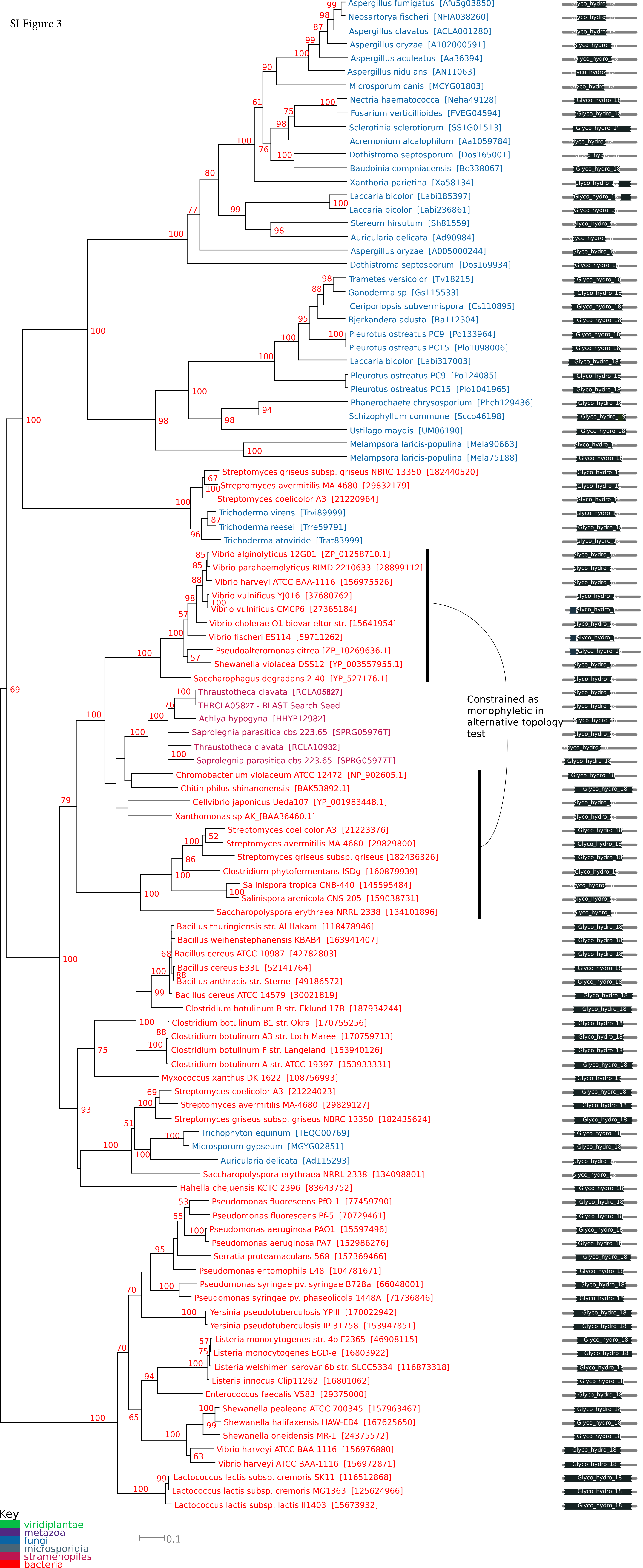
SI Figure 3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Aspergillus nidulans [AN11063]
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Nectria haematococca [Neha49128]
Fusarium verticillioides [FVEG04594]
Sclerotinia sclerotiorum [SS1G01513]
Acremonium alcalophilum [Aa1059784]
Dothistroma septosporum [Dos165001]
Baudoinia compniacensis [Bc338067]
Xanthoria parietina [Xa58134]
Laccaria bicolor [Labi185397]
Laccaria bicolor [Labi236861]
Stereum hirsutum [Sh81559]
Auricularia delicata [Ad90984]
Aspergillus oryzae [A005000244]
Dothistroma septosporum [Dos169934]
Trametes versicolor [Tv18215]
Ganoderma sp [Gs115533]
Ceriporiopsis subvermispora [Cs110895]
Bjerkandera adusta [Ba112304]
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Pleurotus ostreatus PC15 [Plo1098006]
Laccaria bicolor [Labi317003]
Pleurotus ostreatus PC9 [Po124085]
Pleurotus ostreatus PC15 [Plo1041965]
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Schizophyllum commune [Scco46198]
Ustilago maydis [UM06190]
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Streptomyces avermitilis MA-4680 [29832179]
Streptomyces coelicolor A3 [21220964]
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Trichoderma reesei [Trre59791]
Trichoderma atoviride [Trat83999]
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Vibrio parahaemolyticus RIMD 2210633 [28899112]
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Vibrio vulnificus CMCP6 [27365184]
Vibrio cholerae O1 biovar eltor str. [15641954]
Vibrio fischeri ES114 [59711262]
Pseudoalteromonas citrea [ZP_10269636.1]
Shewanella violacea DSS12 [YP_003557955.1]
Saccharophagus degradans 2-40 [YP_527176.1]
Thraustotheca clavata [RCLA05827]
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Achlya hypogyna [HHYP12982]
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Bacillus weihenstephanensis KBAB4 [163941407]
Bacillus cereus ATCC 10987 [42782803]
Bacillus cereus E33L [52141764]
Bacillus anthracis str. Sterne [49186572]
Bacillus cereus ATCC 14579 [30021819]
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Clostridium botulinum F str. Langeland [153940126]
Clostridium botulinum A str. ATCC 19397 [153933331]
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Microsporum gypseum [MGYG02851]
Auricularia delicata [Ad115293]
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Hahella chejuensis KCTC 2396 [83643752]
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Pseudomonas entomophila L48 [104781671]
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Listeria innocua Clip11262 [16801062]
Enterococcus faecalis V583 [29375000]
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Constrained as monophyletic in alternative topology test
Key
viridiplantae
metazoa
fungi
microsporidia
stramenopiles
bacteria
0.1

SI Figure 4


Aspergillus niger [Asni55212]
Aspergillus aculeatus [Aa47516]
Aspergillus carbonarius [Ac176233]
Neosartorya fischeri [NFIA026110]
Aspergillus fumigatus [Afu7g05030]
Aspergillus oryzae [A010000030]
Aspergillus flavus [AFL11297]
Aspergillus niger [Asni41815]
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Aspergillus nidulans [AN2331]
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Aspergillus fumigatus [Afu2g00800]
Aspergillus clavatus [ACLA094210]
Aspergillus nidulans [AN2569]
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Aspergillus aculeatus [Aa54671]
Cryphonectria parasitica [Crpa98319]
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Sclerotinia sclerotiorum [SS1G10071]
Botrytis cinerea [BC1G12517]
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Fusarium oxysporum [FOXG11096]
Fusarium graminearum [FGSG01607]
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Sporotrichum thermophile [Spt52332]
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Fusarium oxysporum [FOXG05617]
Nectria haematococca [Neha44358]
Pyrenophora tritici-repentis [PTRG03919]
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Alternaria brassicicola [AB03768]
Cochliobolus sativus [Cos22904]
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Setosphaeria turcica [St114329]
Stagonospora nodorum [SNU05296]
Verticillium dahliae [VDAG07238]
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Rhystidhysteron rufulum [Rr1533]
Fusarium graminearum [FGSG03121]
Aspergillus niger [Asni173527]
Cryphonectria parasitica [Crpa39853]
Trichoderma atoviride [Trat53176]
Botrytis cinerea [BC1G07527]
Aspergillus nidulans [AN10147]
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Septoria populicola [Sep103661]
Septoria musiva [Smu148522]
Dothistroma septosporum [Dos23103]
Sclerotinia sclerotiorum [SS1G07942]
Botrytis cinerea [BC1G12017]
Pyrenophora tritici-repentis [PTRG00517]
Pyrenophora teres [Pt8800]
Alternaria brassicicola [AB07436]
Cochliobolus sativus [Cos350939]
Cochliobolus heterostrophus [Cohe64232]
Rhystidhysteron rufulum [Rr5076]
Ustilago maydis [UM04708]
Phytophthora infestans [PITG09465]
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Phytophthora sojae [Phso145395]
Phytophthora ramorum [Phra75227]
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Phytophthora sojae [Phso144191]
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Hyaloperonospora parasitica [Hyp712403]
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Blastocladiella emersonii [Bes15g052]
Aspergillus oryzae [A003001295]
Aspergillus flavus [AFL01776]
Aspergillus nidulans [AN4882]
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Neosartorya fischeri [NFIA077100]
Aspergillus fumigatus [Afu5g10170]
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Verticillium dahliae [VDAG08154]
Verticillium albo-atrum [VDBG08488]
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Alternaria brassicicola [AB06199]
Verticillium dahliae [VDAG07144]
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Sclerotinia sclerotiorum [SS1G00040]
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SI Figure 5


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Chaetomium globosum [CHG10762]
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Sporotrichum thermophile [Spt66729]
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Neurospora crassa [NCU09680]
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Mycobacterium abscessus [169631850]
Mycobacterium bovis BCG str. Pasteur 1173P2 [121635972]
Mycobacterium marinum M [183980142]
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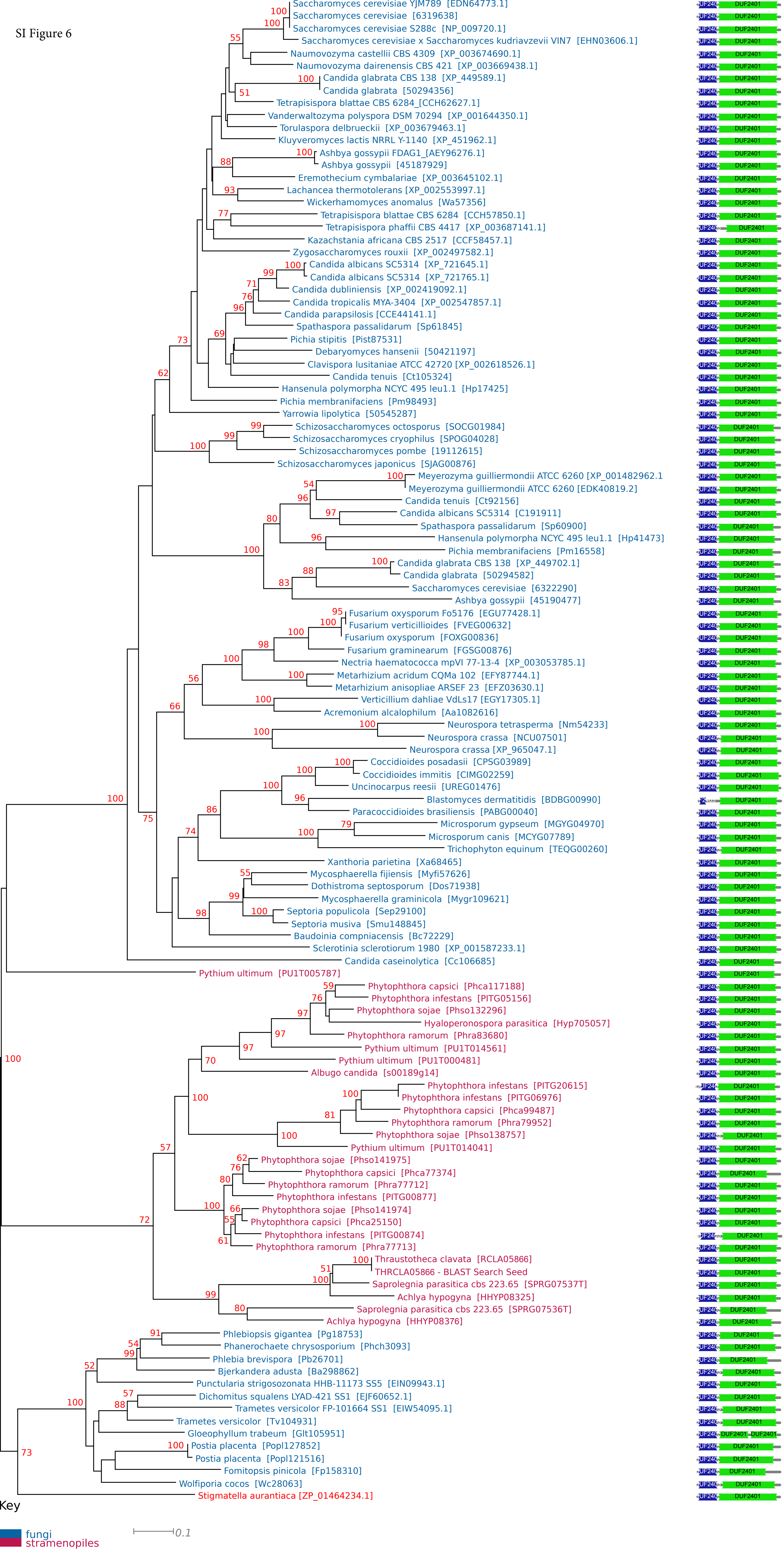
SI Figure 6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Zygosaccharomyces rouxii [XP_002497582.1]
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Uncinocarpus reesii [UREG01476]
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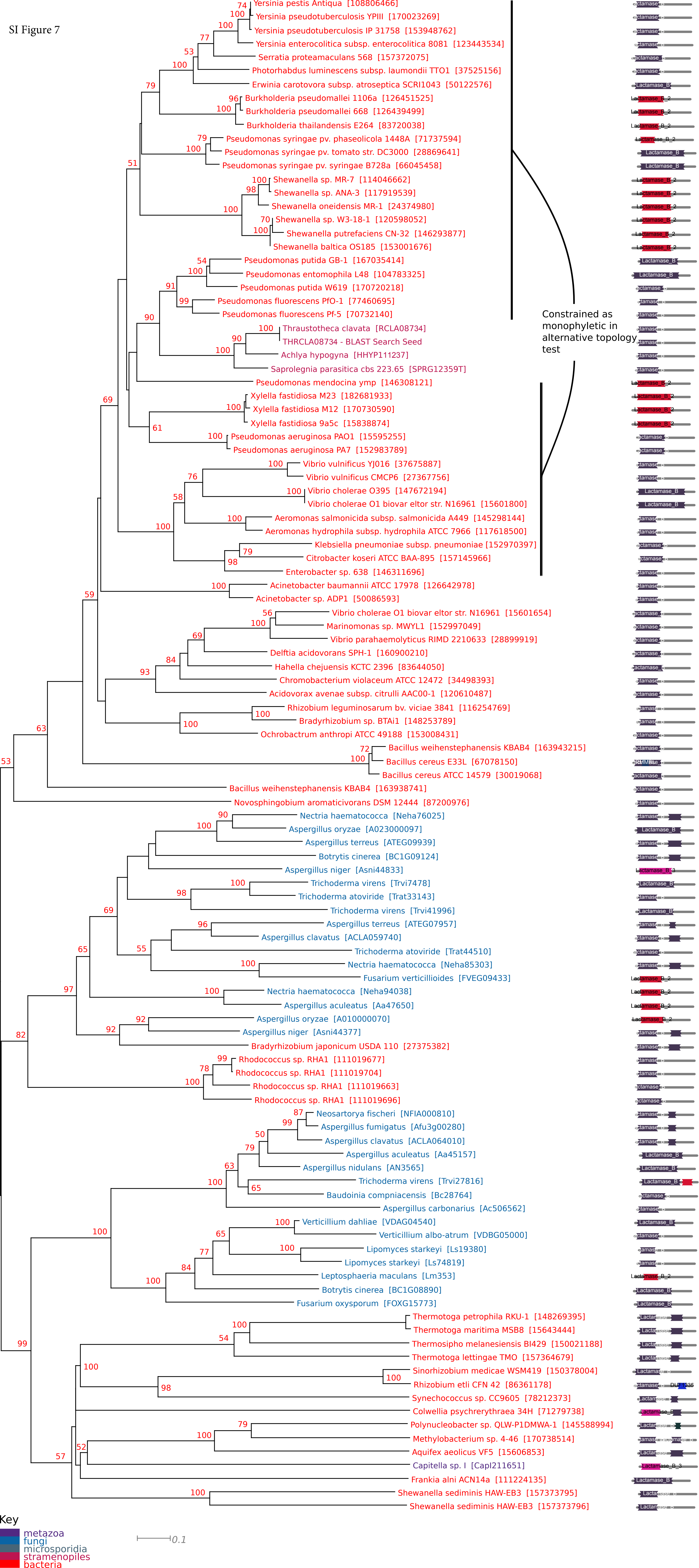
SI Figure 7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Vibrio cholerae O1 biovar eltor str. N16961 [15601654]
100
Marinomonas sp. MWYL1 [152997049]
69
Vibrio parahaemolyticus RIMD 2210633 [28899919]
Delftia acidovorans SPH-1 [160900210]
84
Hahella chejuensis KCTC 2396 [83644050]
93
Chromobacterium violaceum ATCC 12472 [34498393]
Acidovorax avenae subsp. citrulli AAC00-1 [120610487]
Rhizobium leguminosarum bv. viciae 3841 [116254769]
100
Bradyrhizobium sp. BTAi1 [148253789]
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63
Ochrobactrum anthropi ATCC 49188 [153008431]
72
Bacillus weihenstephanensis KBAB4 [163943215]
100
53
Bacillus cereus E33L [67078150]
Bacillus cereus ATCC 14579 [30019068]
Bacillus weihenstephanensis KBAB4 [163938741]
Novosphingobium aromaticivorans DSM 12444 [87200976]
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Nectria haematococca [Neha76025]
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Aspergillus oryzae [A023000097]
Aspergillus terreus [ATEG09939]
Botrytis cinerea [BC1G09124]
Aspergillus niger [Asni44833]
100
Trichoderma virens [Trvi7478]
98
Trichoderma atoviride [Trat33143]
69
Trichoderma virens [Trvi41996]
96
Aspergillus terreus [ATEG07957]
Aspergillus clavatus [ACLA059740]
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Trichoderma atoviride [Trat44510]
100
Nectria haematococca [Neha85303]
Fusarium verticillioides [FVEG09433]
97
100
Nectria haematococca [Neha94038]
Aspergillus aculeatus [Aa47650]
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Aspergillus oryzae [A010000070]
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Aspergillus niger [Asni44377]
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Bradyrhizobium japonicum USDA 110 [27375382]
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Rhodococcus sp. RHA1 [111019677]
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Rhodococcus sp. RHA1 [111019704]
100
Rhodococcus sp. RHA1 [111019663]
Rhodococcus sp. RHA1 [111019696]
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Neosartorya fischeri [NFIA000810]
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Aspergillus fumigatus [Afu3g00280]
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Aspergillus clavatus [ACLA064010]
79
Aspergillus aculeatus [Aa45157]
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Aspergillus nidulans [AN3565]
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Trichoderma virens [Trvi27816]
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Baudoinia compniacensis [Bc28764]
Aspergillus carbonarius [Ac506562]
100
Verticillium dahliae [VDAG04540]
100
65
Verticillium albo-atrum [VDBG05000]
100
Lipomyces starkeyi [Ls19380]
77
Lipomyces starkeyi [Ls74819]
84
Leptosphaeria maculans [Lm353]
100
Botrytis cinerea [BC1G08890]
Fusarium oxysporum [FOXG15773]
Thermotoga petrophila RKU-1 [148269395]
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Thermotoga maritima MSB8 [15643444]
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Thermosipho melanesiensis BI429 [150021188]
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Thermotoga lettingae TMO [157364679]
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Sinorhizobium medicae WSM419 [150378004]
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Rhizobium etli CFN 42 [86361178]
98
Synechococcus sp. CC9605 [78212373]
Colwellia psychrerythraea 34H [71279738]
79
Polynucleobacter sp. QLW-P1DMWA-1 [145588994]
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Methylobacterium sp. 4-46 [170738514]
52
Aquifex aeolicus VF5 [15606853]
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Capitella sp. I [CapI211651]
Frankia alni ACN14a [111224135]
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Shewanella sediminis HAW-EB3 [157373795]
Shewanella sediminis HAW-EB3 [157373796]
Constrained as monophyletic in alternative topology test
Lactamase_B
Lactamase_B_2
Lactamase_B_3
Key
metazoa
fungi
microsporidia
stramenopiles
bacteria
0.1

SI Figure 8


Cochliobolus sativus [Cos186403]
Cochliobolus heterostrophus [Cohe59212]
Setosphaeria turcica [St19432]
Alternaria brassicicola [AB00615]
Pyrenophora teres [Pt9188]
Pyrenophora tritici-repentis [PTRG08873]
Leptosphaeria maculans [Lm8771]
Magnaporthe grisea [MGG08424]
Verticillium dahliae [VDAG05043]
Verticillium albo-atrum [VDBG06505]
Acremonium alcalophilum [Aa1052698]
Fusarium verticillioides [FVEG07261]
Verticillium dahliae [VDAG05294]
Acremonium alcalophilum [Aa2052981]
Acremonium alcalophilum [Aa1058262]
Magnaporthe grisea [MGG07955]
Coprinus cinereus [CC1G12867]
Coprinus cinereus [CC1G12457]
Coprinus cinereus [CC1G08946]
Coprinus cinereus [CC1G08258]
Coprinus cinereus [CC1G04177]
Schizophyllum commune [Scco45736]
Pleurotus ostreatus PC9 [Po89740]
Pleurotus ostreatus PC15 [Plo1079521]
Pleurotus ostreatus PC9 [Po110996]
Pleurotus ostreatus PC15 [Plo1098194]
Cochliobolus sativus [Cos41755]
Cochliobolus heterostrophus [Cohe66085]
Setosphaeria turcica [St91569]
Pyrenophora teres [Pt3457]
Chaetomium globosum [CHG05235]
Sporotrichum thermophile [Spt89603]
Verticillium albo-atrum [VDBG02878]
Fusarium verticillioides [FVEG13207]
Fusarium oxysporum [FOXG15742]
Fusarium graminearum [FGSG10999]
Acremonium alcalophilum [Aa1027453]
Fusarium verticillioides [FVEG08828]
Fusarium oxysporum [FOXG09638]
Fusarium graminearum [FGSG03624]
Nectria haematococca [Neha106153]
Verticillium dahliae [VDAG05042]
Verticillium albo-atrum [VDBG06504]
Magnaporthe grisea [MGG08331]
Nectria haematococca [Neha34530]
Nectria haematococca [Neha19304]
Pyrenophora tritici-repentis [PTRG10827]
Pyrenophora teres [Pt10878]
Alternaria brassicicola [AB06384]
Setosphaeria turcica [St94076]
Stagonospora nodorum [SNU12845]
Cochliobolus sativus [Cos331954]
Cochliobolus heterostrophus [Cohe78501]
Mycosphaerella graminicola [Mygr60105]
Sporotrichum thermophile [Spt56237]
Chaetomium globosum [CHG02074]
Sporotrichum thermophile [Spt49824]
Chaetomium globosum [CHG05134]
Podospora anserina [Pa1250]
Chaetomium globosum [CHG06082]
Agaricus bisporus [Ab79647]
Agaricus bisporus [Ab196181]
Neurospora tetrasperma [Nm104887]
Neurospora crassa [NCU02855]
Neurospora tetrasperma [Nm36383]
Neurospora crassa [NCU07225]
Podospora anserina [Pa213730]
Sporotrichum thermophile [Spt100068]
Rhystidhysteron rufulum [Rr2502]
Sporotrichum thermophile [Spt2121801]
Chaetomium globosum [CHG10559]
Podospora anserina [Pa66400]
Trichoderma virens [Trvi72838]
Trichoderma reesei [Trre123818]
Trichoderma atoviride [Trat82355]
Stereum hirsutum [Sh144729]
Sclerotinia sclerotiorum [SS1G10092]
Aspergillus niger [Asni171269]
Aspergillus carbonarius [Ac180274]
Aspergillus aculeatus [Aa53295]
Cryphonectria parasitica [Crpa19334]
Aspergillus oryzae [A001000111]
Aspergillus flavus [AFL07347]
Aspergillus terreus [ATEG04943]
Neosartorya fischeri [NFIA058160]
Aspergillus fumigatus [Afu6g12210]
Aspergillus clavatus [ACLA085410]
Neosartorya fischeri [NFIA001010]
Aspergillus fumigatus [Afu3g00470]
Ceriporiopsis subvermispora [Cs121827]
Cochliobolus sativus [Cos352331]
Cochliobolus heterostrophus [Cohe103942]
Setosphaeria turcica [St104286]
Phanerochaete chrysosporium [Phch133788]
Phanerochaete carnosa [Pc258624]
Punctularia strigosozonata [Pus60181]
Phlebiopsis gigantea [Pg113976]
Auricularia delicata [Ad123115]
Auricularia delicata [Ad162872]
Sclerotinia sclerotiorum [SS1G03618]
Botrytis cinerea [BC1G03590]
Neosartorya fischeri [NFIA000850]
Aspergillus fumigatus [Afu3g00320]
Aspergillus terreus [ATEG07461]
Aspergillus clavatus [ACLA063140]
Aspergillus oryzae [A120000026]
Aspergillus flavus [AFL08066]
Aspergillus niger [Asni52071]
Aspergillus carbonarius [Ac131127]
Aspergillus nidulans [AN3613]
Aspergillus nidulans [AN9365]
Septoria populicola [Sep17937]
Septoria musiva [Smu53128]
Dothistroma septosporum [Dos137959]
Chaetomium globosum [CHG00129]
Podospora anserina [Pa56810]
Coprinus cinereus [CC1G12474]
Rhystidhysteron rufulum [Rr10821]
Leptosphaeria maculans [Lm3891]
Alternaria brassicicola [AB06428]
Stagonospora nodorum [SNU10865]
Magnaporthe grisea [MGG08401]
Thielavia terrestris [Tt2042100]
Hysterium pulicare [Hp4004]
Bacillus subtilis subsp. subtilis str. 168 [16078944]
Bacillus amyloliquefaciens FZB42 [154687778]
Clostridium phytofermentans ISDg [160880242]
Bacillus halodurans C-125 [15613462]
Clostridium beijerinckii NCIMB 8052 [150017882]
Cytophaga hutchinsonii ATCC 33406 [110638770]
Thermobifida fusca YX [72161617]
Streptomyces coelicolor A3 [21220761]
Streptomyces coelicolor A3 [21218669]
Saccharophagus degradans 2-40 [90022703]
Allomyces macrogynus atcc 38327 [AMAG13259]
Allomyces macrogynus atcc 38327 [AMAG13248]
Dothistroma septosporum [Dos176781]
Cochliobolus sativus [Cos188628]
Cochliobolus heterostrophus [Cohe86196]
Pyrenophora tritici-repentis [PTRG10207]
Setosphaeria turcica [St91125]
Alternaria brassicicola [AB05449]
Pyrenophora teres [Pt8769]
Thielavia terrestris [Tt2050870]
Sporotrichum thermophile [Spt99786]
Thielavia terrestris [Tt2107799]
Trichoderma virens [Trvi65505]
Trichoderma atoviride [Trat46014]
Sclerotinia sclerotiorum [SS1G07749]
Botrytis cinerea [BC1G13645]
Trichoderma reesei [Trre74223]
Trichoderma atoviride [Trat54856]
Trichoderma virens [Trvi8282]
Trichoderma atoviride [Trat90109]
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Thielavia terrestris [Tt2149883]
Cryphonectria parasitica [Crpa50593]
Sorangium cellulosum So ce 56 [162453827]
Sorangium cellulosum So ce 56 [162449235]
Sorangium cellulosum So ce 56 [162451141]
Clostridium thermocellum ATCC 27405 [125975452]
Bacillus pumilus SAFR-032 [157692596]
Magnaporthe grisea [MGG06593]
Aspergillus oryzae [A026000103]
Aspergillus flavus [AFL07138]
Aspergillus oryzae [A103000141]
Aspergillus flavus [AFL12233]
Neosartorya fischeri [NFIA055240]
Aspergillus niger [Asni183088]
Aspergillus aculeatus [Aa28591]
Magnaporthe grisea [MGG09095]
Thielavia terrestris [Tt2110954]
Cochliobolus heterostrophus [Cohe102825]
Setosphaeria turcica [St142403]
Baudoinia compniacensis [Bc36206]
Trichoderma virens [Trvi48966]
Trichoderma reesei [Trre76210]
Trichoderma atoviride [Trat86518]
Nectria haematococca [Neha34339]
Botrytis cinerea [BC1G10789]
Aspergillus nidulans [AN7908]
Thielavia terrestris [Tt2122859]
Rhystidhysteron rufulum [Rr10208]
Aspergillus oryzae [A701000885]
Aspergillus terreus [ATEG10071]
Aspergillus nidulans [AN2632]
Dothistroma septosporum [Dos63078]
Aspergillus terreus [ATEG10379]
Aspergillus niger [Asni55136]
Aspergillus aculeatus [Aa27907]
Streptomyces coelicolor A3 [21224270]
Sporotrichum thermophile [Spt98003]
Chaetomium globosum [CHG04264]
Podospora anserina [Pa511250]
Sporotrichum thermophile [Spt55982]
Chaetomium globosum [CHG09839]
Fusarium verticillioides [FVEG12666]
Fusarium graminearum [FGSG07625]
Stagonospora nodorum [SNU05983]
Schizophyllum commune [Scco49662]
Pyrenophora tritici-repentis [PTRG00700]
Pyrenophora teres [Pt4564]
Alternaria brassicicola [AB07357]
Stagonospora nodorum [SNU00557]
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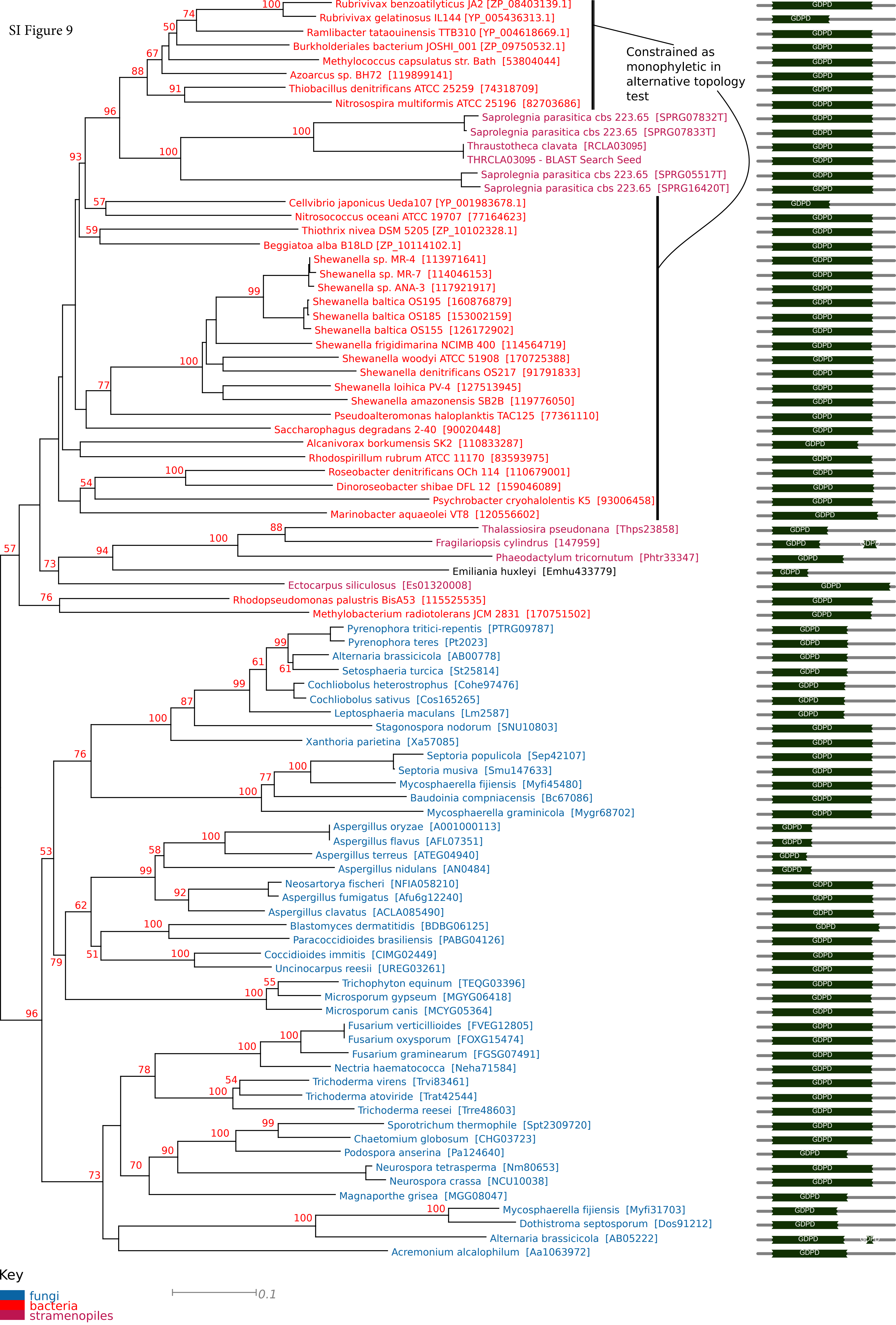
Magnaporthe grisea [MGG09036]
Mycosphaerella graminicola [Mygr68922]
Trichoderma virens [Trvi59892]
Trichoderma atoviride [Trat14213]
Ustilago maydis [UM04309]
Cochliobolus sativus [Cos145203]
Cochliobolus heterostrophus [Cohe60738]
Setosphaeria turcica [St109891]
Pyrenophora tritici-repentis [PTRG07822]
Pyrenophora teres [Pt2648]
Leptosphaeria maculans [Lm7620]
Stagonospora nodorum [SNU04546]
Pleurotus ostreatus PC9 [Po121125]
Pleurotus ostreatus PC15 [Plo152719]
Coprinus cinereus [CC1G01577]
Podospora anserina [Pa01370]
Neosartorya fischeri [NFIA033210]
Aspergillus fumigatus [Afu2g00920]
Aspergillus clavatus [ACLA061510]
Neosartorya fischeri [NFIA087900]
Aspergillus fumigatus [Afu2g12770]
Aspergillus clavatus [ACLA071560]
Aspergillus terreus [ATEG00186]
Aspergillus carbonarius [Ac508000]
Achlya hypogyna [HHYP13461]
ACHHYP13461 - BLAST Search Seed
Saprolegnia parasitica cbs 223.65 [SPRG11812T]
Nectria haematococca [Neha34899]
Coprinus cinereus [CC1G01578]
Chaetomium globosum [CHG03608]
Sorangium cellulosum So ce 56 [162456133]
Sorangium cellulosum So ce 56 [162456136]
Sorangium cellulosum So ce 56 [162452868]
Piromyces sp [Pir29531]
Piromyces sp [Pir23096]
Piromyces sp [Pir23771]
Piromyces sp [Pir26541]
Piromyces sp [Pir53121]
Piromyces sp [Pir23079]
Branch cut by 50%
Constrained as monophyletic in alternative topology test
0.1
Key
fungi
microsporidia
stramenopiles
bacteria

SI Figure 9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Rubrivivax benzoatilyticus JA2 [ZP_08403139.1]
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Rubrivivax gelatinosus IL144 [YP_005436313.1]
50
Ramlibacter tataouinensis TTB310 [YP_004618669.1]
Burkholderiales bacterium JOSHI_001 [ZP_09750532.1]
67
Methylococcus capsulatus str. Bath [53804044]
88
Azoarcus sp. BH72 [119899141]
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Thiobacillus denitrificans ATCC 25259 [74318709]
Nitrosospira multiformis ATCC 25196 [82703686]
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Constrained as monophyletic in alternative topology test
Saprolegnia parasitica cbs 223.65 [SPRG07832T]
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Saprolegnia parasitica cbs 223.65 [SPRG07833T]
Thraustotheca clavata [RCLA03095]
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THRCLA03095 - BLAST Search Seed
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Saprolegnia parasitica cbs 223.65 [SPRG16420T]
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Cellvibrio japonicus Ueda107 [YP_001983678.1]
Nitrosococcus oceani ATCC 19707 [77164623]
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Thiothrix nivea DSM 5205 [ZP_10102328.1]
Beggiatoa alba B18LD [ZP_10114102.1]
Shewanella sp. MR-4 [113971641]
Shewanella sp. MR-7 [114046153]
Shewanella sp. ANA-3 [117921917]
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Shewanella baltica OS195 [160876879]
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Shewanella baltica OS155 [126172902]
Shewanella frigidimarina NCIMB 400 [114564719]
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Shewanella woodyi ATCC 51908 [170725388]
Shewanella denitrificans OS217 [91791833]
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Shewanella loihica PV-4 [127513945]
Shewanella amazonensis SB2B [119776050]
Pseudoalteromonas haloplanktis TAC125 [77361110]
Saccharophagus degradans 2-40 [90020448]
Alcanivorax borkumensis SK2 [110833287]
Rhodospirillum rubrum ATCC 11170 [83593975]
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Roseobacter denitrificans OCh 114 [110679001]
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Dinoroseobacter shibae DFL 12 [159046089]
Psychrobacter cryohalolentis K5 [93006458]
Marinobacter aquaeolei VT8 [120556602]
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Thalassiosira pseudonana [Thps23858]
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Fragilariopsis cylindrus [147959]
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Phaeodactylum tricornutum [Phtr33347]
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Emiliania huxleyi [Emhu433779]
Ectocarpus siliculosus [Es01320008]
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Rhodopseudomonas palustris BisA53 [115525535]
Methylobacterium radiotolerans JCM 2831 [170751502]
Pyrenophora tritici-repentis [PTRG09787]
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Pyrenophora teres [Pt2023]
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Alternaria brassicicola [AB00778]
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Setosphaeria turcica [St25814]
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Cochliobolus heterostrophus [Cohe97476]
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Cochliobolus sativus [Cos165265]
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Leptosphaeria maculans [Lm2587]
Stagonospora nodorum [SNU10803]
Xanthoria parietina [Xa57085]
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Septoria populicola [Sep42107]
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Septoria musiva [Smu147633]
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Mycosphaerella fijiensis [Myfi45480]
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Baudoinia compniacensis [Bc67086]
Mycosphaerella graminicola [Mygr68702]
Aspergillus oryzae [A001000113]
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Aspergillus flavus [AFL07351]
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Aspergillus terreus [ATEG04940]
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Aspergillus nidulans [AN0484]
Neosartorya fischeri [NFIA058210]
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Aspergillus fumigatus [Afu6g12240]
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Aspergillus clavatus [ACLA085490]
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Blastomyces dermatitidis [BDBG06125]
Paracoccidioides brasiliensis [PABG04126]
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Coccidioides immitis [CIMG02449]
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Uncinocarpus reesii [UREG03261]
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Trichophyton equinum [TEQG03396]
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Microsporum gypseum [MGYG06418]
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Microsporum canis [MCYG05364]
Fusarium verticillioides [FVEG12805]
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Fusarium oxysporum [FOXG15474]
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Fusarium graminearum [FGSG07491]
78
Nectria haematococca [Neha71584]
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Trichoderma virens [Trvi83461]
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Trichoderma atoviride [Trat42544]
Trichoderma reesei [Trre48603]
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Sporotrichum thermophile [Spt2309720]
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Chaetomium globosum [CHG03723]
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Podospora anserina [Pa124640]
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Neurospora tetrasperma [Nm80653]
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Neurospora crassa [NCU10038]
Magnaporthe grisea [MGG08047]
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Mycosphaerella fijiensis [Myfi31703]
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Dothistroma septosporum [Dos91212]
Alternaria brassicicola [AB05222]
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0.1
Key
fungi
bacteria
stramenopiles

SI Figure 10


Zea mays [Zm19523914]
Sorghum bicolor [Sbi142971]
Sorghum bicolor [Sbi4893392]
Zea mays [Zm19565975]
Zea mays [Zm19565974]
Brachypodium distachyon [Bd16481376]
Setaria italica [Si19677778]
Oryza sativa [115434790]
Aquilegia coerulea [Ac18148078]
Zea mays [Zm19512810]
Sorghum bicolor [Sbi4767316]
Setaria italica [Si19698080]
Oryza sativa [115462347]
Brachypodium distachyon [Bd16484621]
Manihot esculenta [Me17981102]
Manihot esculenta [Me17981103]
Ricinus communis [Rc16810560]
Manihot esculenta [Me17962935]
Populus trichocarpa [Potr810176]
Populus trichocarpa [Potr829577]
Cucumis sativus [Cs16958029]
Citrus sinensis [Cs18127633]
Citrus clementina [Cc19278658]
Arabidopsis thaliana [15219031]
Arabidopsis lyrata [Al16034475]
Prunus persica [Pp17650319]
Eucalyptus grandis [Eg18761059]
Solanum tuberosum [400049712]
Solanum lycopersicum [Sl06g06809]
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Solanum lycopersicum [Sl03g11662]
Mimulus guttatus [Mt17689969]
Cucumis sativus [Cs16959329]
Glycine max [Gm16266044]
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Glycine max [Gm16293728]
Carica papaya [Cp16404621]
Solanum tuberosum [400016959]
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Aquilegia coerulea [Ac18141465]
Mimulus guttatus [Mt17679529]
Aquilegia coerulea [Ac18148026]
Medicago truncatula [Mt17452027]
Medicago truncatula [Mt17452062]
Glycine max [Gm16262029]
Ricinus communis [Rc16811286]
Manihot esculenta [Me17985959]
Populus trichocarpa [Potr763496]
Mimulus guttatus [Mt17679404]
Solanum lycopersicum [Sl12g01117]
Eucalyptus grandis [Eg18796976]
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Zea mays [Zm19541852]
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🟥 stramenopiles
🟥 bacteria
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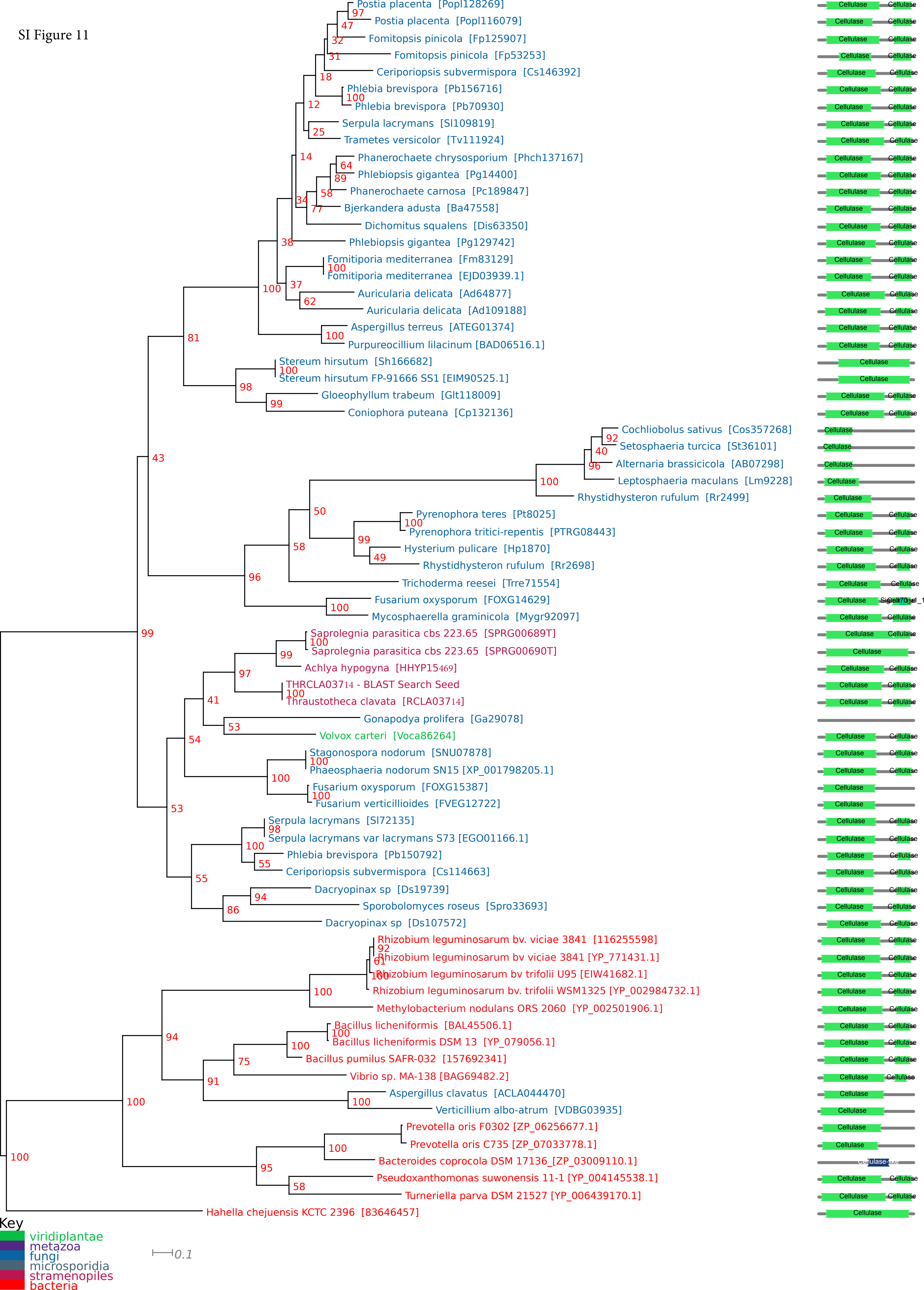
SI Figure 11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bacteria
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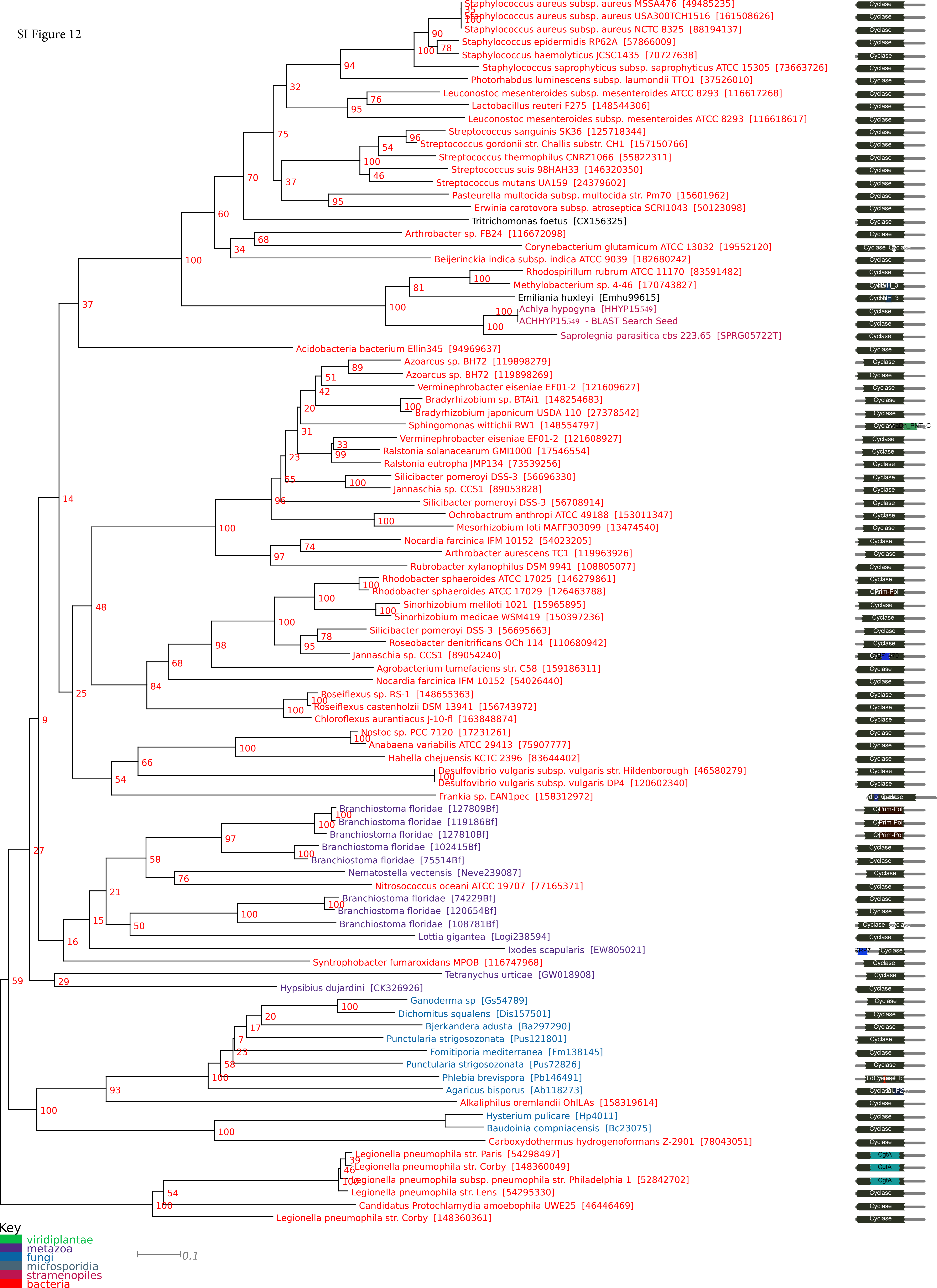
SI Figure 12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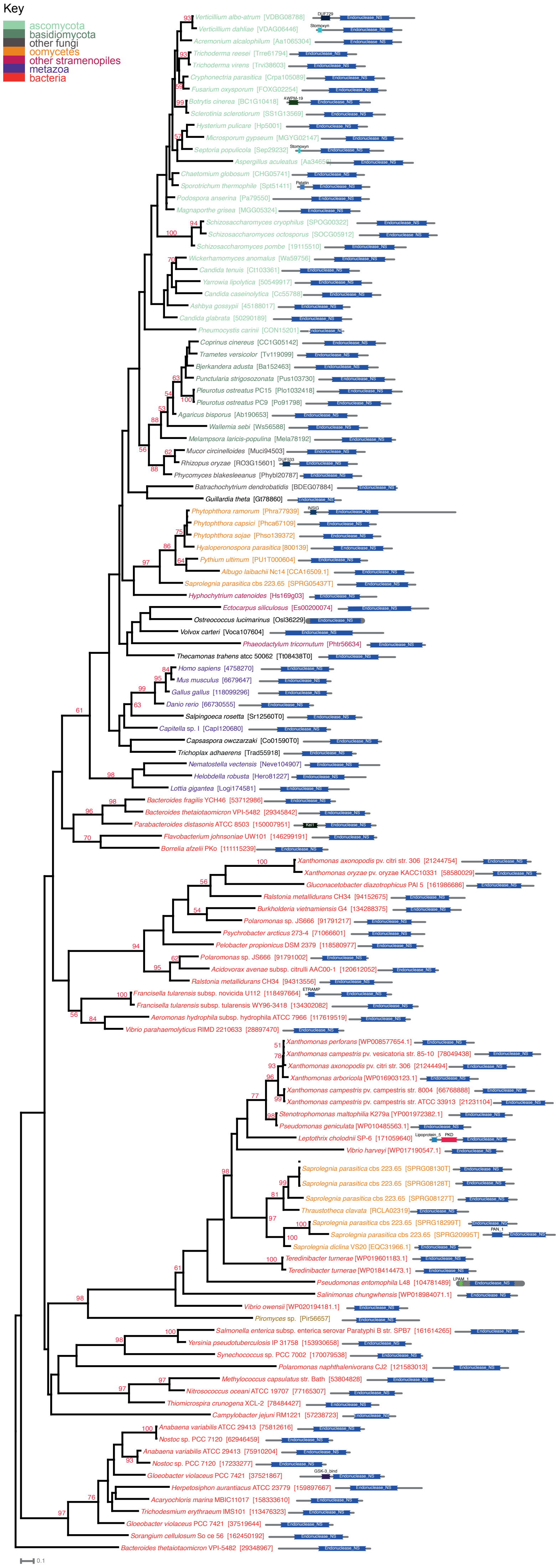
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Saprolegnia diclina VS20 [EQC31966.1]
Teredinibacter turnerae [WP019601183.1]
Teredinibacter turnerae [WP018414473.1]
Pseudomonas entomophila L48 [104781489]
LPAM_1
Salinimonas chungwhensis [WP018984071.1]
Vibrio owensii [WP020194181.1]
Piromyces sp. [Pir56657]
Salmonella enterica subsp. enterica serovar Paratyphi B str. SPB7 [161614265]
Yersinia pseudotuberculosis IP 31758 [153930658]
Synechococcus sp. PCC 7002 [170079538]
Polaromonas naphthalenivorans CJ2 [121583013]
Methylococcus capsulatus str. Bath [53804828]
Nitrosococcus oceani ATCC 19707 [77165307]
Thiomicrospira crunogena XCL-2 [78484427]
Campylobacter jejuni RM1221 [57238723]
Anabaena variabilis ATCC 29413 [75812616]
Nostoc sp. PCC 7120 [62946459]
Anabaena variabilis ATCC 29413 [75910204]
Nostoc sp. PCC 7120 [17233277]
Gloeobacter violaceus PCC 7421 [37521867]
GSK-3_bind
Herpetosiphon aurantiacus ATCC 23779 [159897667]
Acaryochloris marina MBIC11017 [158333610]
Trichodesmium erythraeum IMS101 [113476323]
Gloeobacter violaceus PCC 7421 [37519644]
Sorangium cellulosum So ce 56 [162450192]
Bacteroides thetaiotaomicron VPI-5482 [29348967]
0.1