

## SymPortal final phylogenetic tree - MS biogeo Sept 2021

```
rm(list = ls())  
library(tidyr)  
library(purrr)  
library(metagMisc)
```

```
##  
## Attaching package: 'metagMisc'  
  
## The following object is masked from 'package:purrr':  
##  
##      some
```

```
library(kableExtra)  
library(reshape2)
```

```
##  
## Attaching package: 'reshape2'  
  
## The following object is masked from 'package:tidyr':  
##  
##      smiths
```

```
library(stringr)  
library(phyloseq)  
library(magrittr)
```

```
##  
## Attaching package: 'magrittr'  
  
## The following object is masked from 'package:purrr':  
##  
##      set_names  
  
## The following object is masked from 'package:tidyr':  
##  
##      extract
```

```
library(metagMisc)  
library(randomForest)
```

```
## randomForest 4.6-14
```

```
## Type rfNews() to see new features/changes/bug fixes.
```

```
library(seqinr)
library(gridExtra)
```

```
##
## Attaching package: 'gridExtra'

## The following object is masked from 'package:randomForest':
##
##      combine
```

```
library(remotes)
```

```
##
## Attaching package: 'remotes'

## The following object is masked from 'package:metagMisc':
##
##      add_metadata
```

```
library(igraph)
```

```
##
## Attaching package: 'igraph'

## The following objects are masked from 'package:purrr':
##
##      compose, simplify

## The following object is masked from 'package:tidyr':
##
##      crossing

## The following objects are masked from 'package:stats':
##
##      decompose, spectrum

## The following object is masked from 'package:base':
##
##      union
```

```
library(ellipse)
```

```
##
## Attaching package: 'ellipse'

## The following object is masked from 'package:graphics':
##
##      pairs
```

```
library(indicspecies)
```

```
## Loading required package: permute
```

```
##
```

```
## Attaching package: 'permute'
```

```
## The following object is masked from 'package:igraph':
```

```
##
```

```
##     permute
```

```
## The following object is masked from 'package:seqinr':
```

```
##
```

```
##     getType
```

```
library(yhat)
```

```
## Registered S3 methods overwritten by 'yacca':
```

```
##   method      from
```

```
##   plot.cca     vegan
```

```
##   print.cca    vegan
```

```
##   print.summary.cca vegan
```

```
##   summary.cca  vegan
```

```
library("dunn.test")
```

```
library("treeio")
```

```
## treeio v1.16.2 For help: https://yulab-smu.top/treedata-book/
```

```
##
```

```
## If you use treeio in published research, please cite:
```

```
##
```

```
## LG Wang, TTY Lam, S Xu, Z Dai, L Zhou, T Feng, P Guo, CW Dunn, BR Jones, T Bradley, H Zhu, Y Guan, Y
```

```
##
```

```
## Attaching package: 'treeio'
```

```
## The following object is masked from 'package:igraph':
```

```
##
```

```
##     parent
```

```
## The following object is masked from 'package:seqinr':
```

```
##
```

```
##     read.fasta
```

```
## Remember to setwd to where rds files are found
```

```
##setwd("~/Users/victoriamarieglynn/Desktop/Desktop_May2021/CC_11May2021_DINOenv")
```

```
##Read rds file generated from DADA2
```

```
ps <- readRDS("/Users/victoriamarieglynn/Desktop/Desktop_May2021/CC_11May2021_DINOenv/symITSps_may2021..")
```

```
ps
```

```
## phyloseq-class experiment-level object
## otu_table() OTU Table: [ 11374 taxa and 416 samples ]
## sample_data() Sample Data: [ 416 samples by 21 sample variables ]
## phy_tree() Phylogenetic Tree: [ 11374 tips and 11372 internal nodes ]
```

```
taxa_names(ps) <- paste0("asv", seq(ntaxa(ps)))
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
# explicitly rename taxas to asvs
```

```
otu <- otu_table(ps)
sam <- sample_data(ps)
```

```
FastTree_Pdam <- read.newick("/Users/victoriamarieglynn/Desktop/Desktop_May2021/CC_11May2021_DINOenv/Fa
tre <- phy_tree(FastTree_Pdam)
```

```
##Taxa import, below is for the NCBI search, which was as follows on our Compute Canada clusters:
```

```
###blastn \
###-query uniqueSeqs_F-asv.fasta \
###-db nt \
###-out SymPortal_NCBICrossref_Fb5.csv \
###-evalue 1e-5 \
###-outfmt "6 qseqid sseqid sscinames scomnames sskingdoms stitle qstart qend mismatch evalue length" \
###-max_target_seqs 5
```

```
## For NCBI, I manually looked through the generated table to assign clade and type level identification
```

```
##I also used SymPortal for taxonomic assignment, but this did not result in ITS clades being grouped to
```

```
###vsearch --usearch_global uniqueSeqs_DINO_Stewart.fasta --db refSeqDB.fa --blast6out DINOSt_taxa.txt
```

```
taxtable<-read.csv("/Users/victoriamarieglynn/Desktop/Desktop_May2021/CC_11May2021_DINOenv/SymPortaltaxa
summary(taxtable)
```

```
##      ASV              ITSclade      ITStype
## Length:1645      Length:1645      Length:1645
## Class :character  Class :character  Class :character
## Mode :character   Mode :character   Mode :character
```

```
##This CSVs has all N sequences removed, as not informative
```

```
## taxonomy table into matrix
taxmat<-as.matrix(taxtable[,2:3])
rownames(taxmat)<-taxtable$ASV
```

```
##Combine the taxonomy matrix and the otu_table (otus) into a phyloseq object
```

```
TAX = tax_table(taxmat)
```

```
## Check if any duplicated row names
```

```
duplicated(TAX)
```

```
## asv135 asv441 asv649 asv1212 asv1847 asv2260 asv3045 asv4205
## FALSE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv9973 asv9651 asv140 asv702 asv1100 asv2151 asv10527 asv1582
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv143 asv569 asv710 asv1918 asv2722 asv464 asv2440 asv6849
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv717 asv24 asv211 asv214 asv217 asv437 asv439 asv503
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv561 asv582 asv666 asv707 asv738 asv887 asv1157 asv1473
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv1557 asv2062 asv3049 asv3124 asv5589 asv2785 asv535 asv5748
## TRUE TRUE TRUE TRUE FALSE FALSE FALSE TRUE
## asv8319 asv171 asv784 asv929 asv1314 asv1841 asv2222 asv2231
## TRUE FALSE TRUE TRUE TRUE TRUE TRUE TRUE
## asv2386 asv2519 asv2520 asv2964 asv4503 asv10448 asv11805 asv48
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv82 asv93 asv102 asv176 asv258 asv311 asv332 asv359
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv426 asv869 asv910 asv982 asv1004 asv1109 asv1163 asv1227
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv1258 asv1276 asv1416 asv1670 asv1777 asv1851 asv1945 asv2014
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv2119 asv2290 asv2357 asv3123 asv3147 asv4923 asv5105 asv8541
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv8770 asv8771 asv9622 asv10449 asv10496 asv10503 asv2585 asv2356
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv494 asv5498 asv6423 asv8772 asv9638 asv737 asv1966 asv1051
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv1129 asv1574 asv2557 asv2686 asv19 asv114 asv190 asv204
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv249 asv297 asv325 asv354 asv477 asv663 asv931 asv1000
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv1031 asv1104 asv1199 asv1259 asv1406 asv1467 asv1807 asv2067
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv2323 asv3208 asv3404 asv5177 asv5847 asv7344 asv339 asv456
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv2783 asv349 asv121 asv834 asv1446 asv1563 asv1649 asv1671
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv1609 asv1791 asv1906 asv2007 asv2203 asv2475 asv2607 asv2892
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv3052 asv3430 asv3666 asv4051 asv4206 asv5182 asv5504 asv1871
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv10504 asv139 asv2503 asv524 asv11449 asv89 asv858 asv971
## TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE
## asv1441 asv2521 asv57 asv97 asv626 asv763 asv1043 asv1115
```

##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv1494	asv1676	asv1700	asv1740	asv1822	asv2047	asv1093	asv183
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv201	asv3048	asv8320	asv10450	asv6160	asv293	asv510	asv621
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv2489	asv7884	asv8559	asv9473	asv9935	asv9948	asv10464	asv10490
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10567	asv10604	asv10586	asv10758	asv11853	asv1	asv17	asv13
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv58	asv72	asv73	asv141	asv154	asv199	asv226	asv239
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv242	asv363	asv427	asv525	asv547	asv568	asv609	asv672
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv708	asv716	asv828	asv853	asv900	asv1059	asv1280	asv1370
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv1431	asv1512	asv1725	asv1790	asv1810	asv1872	asv1889	asv1976
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv2301	asv2343	asv2813	asv2993	asv3210	asv3241	asv3321	asv3602
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv3601	asv3781	asv3903	asv4114	asv4158	asv4442	asv4563	asv4564
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv4636	asv5421	asv5503	asv6049	asv6162	asv6550	asv6989	asv6999
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv7354	asv7521	asv7890	asv7893	asv9184	asv9657	asv9664	asv9936
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9939	asv9952	asv10432	asv10438	asv10443	asv10442	asv10477	asv10491
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10492	asv10556	asv10578	asv10576	asv10577	asv10593	asv11826	asv11847
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv11850	asv2565	asv8331	asv9405	asv131	asv376	asv908	asv916
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv1937	asv2342	asv2941	asv6691	asv7512	asv7889	asv8778	asv9938
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9953	asv10462	asv10582	asv10884	asv256	asv319	asv1546	asv6548
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv6848	asv9956	asv10560	asv10564	asv11860	asv831	asv8991	asv10230
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv3	asv398	asv1038	asv1073	asv1245	asv1825	asv2410	asv3711
##	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv4159	asv4638	asv4858	asv6053	asv6552	asv8332	asv8333	asv8796
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9865	asv9866	asv11459	asv29	asv31	asv45	asv64	asv291
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv374	asv422	asv10006	asv342	asv2621	asv3746	asv1539	asv2743
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv266	asv1627	asv2764	asv6008	asv6551	asv8	asv2	asv12
##	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	TRUE	TRUE
##	asv21	asv15	asv22	asv26	asv25	asv33	asv9	asv36
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv37	asv39	asv41	asv42	asv43	asv54	asv53	asv50
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv52	asv46	asv65	asv67	asv69	asv74	asv78	asv79
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv75	asv80	asv84	asv83	asv85	asv86	asv88	asv94

##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv104	asv105	asv106	asv109	asv119	asv118	asv122	asv127
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv128	asv129	asv132	asv133	asv134	asv138	asv142	asv149
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv151	asv153	asv155	asv156	asv158	asv160	asv165	asv170
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv177	asv178	asv179	asv180	asv184	asv188	asv198	asv200
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv186	asv209	asv220	asv225	asv227	asv230	asv233	asv234
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##	asv235	asv237	asv245	asv244	asv252	asv246	asv254	asv260
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##	asv261	asv262	asv265	asv267	asv276	asv279	asv278	asv292
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##	asv298	asv302	asv305	asv306	asv313	asv317	asv321	asv331
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv336	asv341	asv344	asv348	asv353	asv364	asv365	asv369
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv375	asv379	asv382	asv389	asv386	asv396	asv397	asv399
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv401	asv404	asv406	asv412	asv429	asv442	asv443	asv444
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv462	asv466	asv469	asv485	asv483	asv489	asv495	asv498
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##	asv506	asv507	asv511	asv518	asv527	asv551	asv557	asv570
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##	asv578	asv586	asv591	asv593	asv594	asv597	asv602	asv612
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##	asv614	asv618	asv635	asv636	asv638	asv647	asv653	asv655
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##	asv660	asv661	asv662	asv669	asv680	asv670	asv698	asv719
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##	asv772	asv773	asv714	asv800	asv808	asv810	asv817	asv852
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##	asv857	asv860	asv871	asv875	asv880	asv884	asv907	asv912
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##	asv1156	asv1165	asv1164	asv1177	asv1178	asv1200	asv1210	asv1216
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##	asv1425	asv1430	asv1435	asv1436	asv1450	asv1472	asv1488	asv1597
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##	asv1613	asv1614	asv1626	asv1630	asv1634	asv1647	asv1662	asv1701
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##	asv1720	asv1751	asv1778	asv1788	asv1823	asv1824	asv1859	asv1887

##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv1886	asv1893	asv1905	asv1915	asv1930	asv1944	asv1964	asv2026
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##	asv2028	asv2036	asv2073	asv2105	asv2137	asv2162	asv2275	asv2276
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv2289	asv2302	asv2324	asv2341	asv2389	asv2439	asv2455	asv2504
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv2522	asv2566	asv2584	asv2587	asv2606	asv2605	asv2624	asv2658
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##	asv2675	asv2761	asv2744	asv2801	asv2803	asv2890	asv2891	asv2907
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##	asv2937	asv2942	asv2965	asv3013	asv3051	asv3146	asv3165	asv3209
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##	asv3242	asv3268	asv3288	asv3471	asv3470	asv3469	asv3472	asv3498
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##	asv3561	asv3565	asv3566	asv3706	asv3821	asv3952	asv3951	asv3996
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##	asv4044	asv4046	asv4111	asv4110	asv4203	asv4204	asv4208	asv4207
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv4376	asv4375	asv4378	asv4441	asv4566	asv4634	asv4633	asv4635
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##	asv4654	asv4709	asv4853	asv4855	asv4854	asv4857	asv4984	asv5104
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##	asv5103	asv5102	asv5178	asv5179	asv5181	asv5261	asv5258	asv5259
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##	asv5260	asv5262	asv5335	asv5334	asv5420	asv5419	asv5502	asv5506
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv5669	asv5668	asv5752	asv5749	asv5754	asv5848	asv5852	asv5855
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv5952	asv6161	asv6163	asv6293	asv6290	asv6289	asv6420	asv6419
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv6543	asv6542	asv6544	asv6547	asv6545	asv6549	asv6690	asv6692
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv6693	asv6697	asv6698	asv6700	asv6845	asv6846	asv6847	asv6852
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv6853	asv6991	asv6994	asv6992	asv6998	asv7001	asv7002	asv7167
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv7168	asv7172	asv7174	asv7175	asv7349	asv7342	asv7345	asv7346
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv7347	asv7348	asv7351	asv7352	asv7356	asv7511	asv7509	asv7513
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv7514	asv7515	asv7516	asv7517	asv7522	asv7523	asv7700	asv7702
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv7701	asv7709	asv7706	asv7711	asv7714	asv7715	asv7716	asv7717
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv7885	asv7883	asv7888	asv7887	asv7894	asv7897	asv8099	asv8097
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv8098	asv8102	asv8100	asv8104	asv8103	asv8105	asv8106	asv8107
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv8108	asv8109	asv8318	asv8322	asv8323	asv8328	asv8330	asv8329
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv8334	asv8543	asv8545	asv8546	asv8548	asv8549	asv8551	asv8558
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv8560	asv8561	asv8563	asv8774	asv8776	asv8775	asv8777	asv8780



##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv8784	asv8785	asv8786	asv8788	asv8789	asv8790	asv8791	asv8792
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv8793	asv8795	asv8779	asv8988	asv8987	asv8985	asv8992	asv8994
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv8993	asv9001	asv9000	asv9002	asv9003	asv9007	asv9006	asv9011
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9010	asv9027	asv9026	asv9185	asv9187	asv9190	asv9189	asv9186
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9191	asv9188	asv9192	asv9193	asv9194	asv9197	asv9204	asv9205
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9206	asv9207	asv9208	asv9210	asv9214	asv9213	asv9216	asv9196
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9402	asv9406	asv9407	asv9410	asv9412	asv9413	asv9419	asv9418
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9421	asv9414	asv9423	asv9426	asv9428	asv9436	asv9437	asv9438
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9441	asv9443	asv9459	asv9475	asv9551	asv9619	asv9620	asv9624
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9625	asv9627	asv9626	asv9629	asv9631	asv9633	asv9632	asv9634
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9635	asv9641	asv9658	asv9661	asv9662	asv9656	asv9668	asv9669
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9670	asv9671	asv9675	asv9679	asv9706	asv9708	asv9726	asv9733
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9820	asv9867	asv9868	asv9927	asv9928	asv9926	asv9930	asv9929
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9940	asv9942	asv9943	asv9951	asv9950	asv9955	asv9964	asv9966
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9967	asv9968	asv9978	asv9979	asv9982	asv9985	asv9986	asv9987
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9989	asv9993	asv9992	asv9994	asv9995	asv9997	asv9999	asv10001
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10002	asv10003	asv10004	asv10005	asv10007	asv10008	asv10009	asv10011
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10010	asv10015	asv10055	asv10056	asv10057	asv10058	asv10098	asv10109
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10111	asv10112	asv10110	asv10113	asv10224	asv10225	asv10228	asv10231
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10233	asv10232	asv10327	asv10426	asv10427	asv10428	asv10429	asv10435
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10437	asv10440	asv10439	asv10445	asv10447	asv10446	asv10452	asv10453
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10454	asv10456	asv10458	asv10459	asv10466	asv10468	asv10470	asv10473
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10478	asv10480	asv10481	asv10484	asv10485	asv10493	asv10497	asv10502
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10505	asv10506	asv10507	asv10530	asv10531	asv10533	asv10538	asv10539
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10541	asv10542	asv10551	asv10552	asv10553	asv10554	asv10555	asv10559
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10562	asv10566	asv10568	asv10569	asv10572	asv10579	asv10581	asv10590
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10587	asv10591	asv10599	asv10598	asv10597	asv10600	asv10601	asv10603

##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10605	asv10607	asv10608	asv10612	asv10610	asv10611	asv10613	asv10614
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10615	asv10617	asv10609	asv10616	asv10618	asv10606	asv10631	asv10632
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10726	asv10724	asv10728	asv10731	asv10729	asv10733	asv10756	asv10888
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10886	asv10887	asv10889	asv10891	asv10934	asv10937	asv10933	asv10936
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10938	asv10940	asv10941	asv10942	asv10944	asv10945	asv11230	asv11229
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv11231	asv11234	asv11236	asv11235	asv11239	asv11240	asv11446	asv11444
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv11445	asv11447	asv11448	asv11450	asv11451	asv11452	asv11453	asv11454
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv11455	asv11456	asv11458	asv11457	asv11763	asv11769	asv11770	asv11774
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv11777	asv11779	asv11781	asv11786	asv11788	asv11789	asv11795	asv11796
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv11806	asv11811	asv11813	asv11815	asv11816	asv11818	asv11820	asv11819
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv11825	asv11823	asv11822	asv11824	asv11828	asv11830	asv11834	asv11835
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv11837	asv11840	asv11843	asv11851	asv11852	asv11854	asv11856	asv11858
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv11859	asv11861	asv38	asv87	asv108	asv174	asv447	asv814
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv894	asv1374	asv1796	asv2224	asv2583	asv2620	asv2760	asv3100
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv3122	asv3239	asv3705	asv4708	asv5590	asv5951	asv6438	asv6993
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv7704	asv7705	asv7708	asv8110	asv8547	asv8798	asv8799	asv8986
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv8990	asv9417	asv9422	asv9425	asv9640	asv9663	asv9676	asv9677
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9681	asv9932	asv10099	asv10114	asv10548	asv10592	asv10723	asv10885
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10939	asv10949	asv11814	asv4	asv30	asv47	asv51	asv111
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv120	asv150	asv169	asv172	asv238	asv269	asv272	asv285
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv289	asv294	asv308	asv347	asv371	asv388	asv407	asv487
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv559	asv584	asv782	asv786	asv897	asv978	asv986	asv993
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv1016	asv1044	asv1125	asv1180	asv1233	asv1561	asv1707	asv1812
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv1846	asv1894	asv1904	asv2027	asv2261	asv2387	asv2409	asv2721
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv2909	asv3213	asv3289	asv3431	asv3783	asv3824	asv3902	asv4112
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv4639	asv4776	asv4859	asv5101	asv5180	asv5497	asv5499	asv5500
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv5591	asv6166	asv6318	asv6425	asv6582	asv6855	asv7169	asv7350

##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv7707	asv7718	asv7886	asv7911	asv8797	asv8989	asv9008	asv9025
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9037	asv9219	asv9217	asv9408	asv9409	asv9415	asv9416	asv9427
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9628	asv9680	asv9705	asv9704	asv9937	asv9946	asv9949	asv10000
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10100	asv10229	asv10457	asv10471	asv10472	asv10475	asv10479	asv10483
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10486	asv10487	asv10534	asv10543	asv10550	asv10580	asv10602	asv10619
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10630	asv10633	asv10725	asv10727	asv10730	asv10732	asv10757	asv10759
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10890	asv10932	asv10935	asv10943	asv10948	asv11228	asv11227	asv11232
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv11233	asv11237	asv11238	asv11241	asv44	asv1040	asv3782	asv4777
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv5336	asv5333	asv6048	asv6164	asv6995	asv7891	asv9623	asv9642
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9965	asv10465	asv10532	asv10540	asv1186	asv6546	asv10469	asv10474
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10585	asv10947	asv10950	asv4640	asv6553	asv7357	asv8335	asv8565
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9442	asv9674	asv10226	asv10946	asv5425	asv8564	asv9215	asv3570
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv290	asv2832	asv145	asv2604	asv3377	asv735	asv1834	asv11849
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv3164	asv1950	asv6168	asv2943	asv7170	asv2622	asv6	asv126
##	FALSE	FALSE	TRUE	FALSE	TRUE	TRUE	FALSE	TRUE
##	asv194	asv224	asv232	asv247	asv286	asv318	asv393	asv432
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv631	asv633	asv659	asv803	asv903	asv953	asv1240	asv1283
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv1696	asv2438	asv3032	asv3148	asv3872	asv5850	asv7710	asv8316
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv8781	asv9963	asv10518	asv10545	asv10549	asv1513	asv7	asv40
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv68	asv137	asv152	asv166	asv411	asv452	asv455	asv600
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv608	asv756	asv769	asv840	asv901	asv905	asv918	asv956
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv1112	asv1264	asv1540	asv1602	asv1835	asv1843	asv1993	asv2106
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv2223	asv2543	asv2745	asv2746	asv2966	asv3240	asv3664	asv3707
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv3747	asv4045	asv7165	asv7510	asv8101	asv8324	asv8544	asv8783
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv9636	asv9954	asv10455	asv10467	asv10476	asv10500	asv10509	asv10510
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10513	asv10525	asv10528	asv10529	asv10535	asv10537	asv10460	asv3182
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv10498	asv10561	asv2358	asv4440	asv10524	asv10494	asv10589	asv27
##	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
##	asv715	asv1541	asv1566	asv1298	asv77	asv91	asv112	asv228

```

##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv323 asv421 asv475 asv528 asv691 asv928 asv1170 asv1242
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv1294 asv1468 asv1654 asv2202 asv2371 asv3567 asv5849 asv9195
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv9420 asv10515 asv10521 asv144 asv110 asv8321 asv8782 asv9411
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv9961 asv10461 asv10488 asv1878 asv3073 asv1589 asv3499 asv7166
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv9424 asv9958 asv10489 asv81 asv1362 asv4259 asv9960 asv10517
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv107 asv4315 asv9975 asv10451 asv10547 asv2099 asv3822 asv61
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv8550 asv9957 asv10522 asv10536 asv55 asv90 asv162 asv229
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv529 asv742 asv1116 asv1545 asv1860 asv2241 asv3011 asv4778
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv9639 asv10482 asv10499 asv10512 asv10523 asv10526 asv10565 asv76
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv268 asv273 asv2074 asv2370 asv2421 asv2851 asv9959 asv10495
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv10508 asv10514 asv205 asv754 asv1623 asv5047 asv8773 asv9947
##      TRUE      TRUE      FALSE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv10463 asv10501 asv10519 asv49 asv727 asv1735 asv3904 asv4314
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv7703 asv8317 asv8542 asv9945 asv282 asv335 asv2068 asv2762
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv301 asv16 asv490 asv841 asv1444 asv2388 asv2869 asv3537
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv10516 asv10520 asv23 asv425 asv491 asv508 asv509 asv1364
##      TRUE      TRUE      FALSE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv1397 asv1432 asv1586 asv1842 asv2173 asv5046 asv5418 asv9404
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv9962 asv1888 asv654 asv849 asv9637 asv9660 asv10511 asv14
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      FALSE
## asv175 asv222 asv322 asv430 asv516 asv980 asv1518 asv1747
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv1797 asv2344 asv2576 asv6850 asv9630 asv9941 asv9944 asv9984
##      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv5750 asv7898 asv2303 asv4924 asv9667 asv6047 asv384 asv450
##      FALSE      FALSE      FALSE      TRUE      TRUE      TRUE      TRUE      TRUE
## asv461 asv730 asv866 asv1262 asv4047
##      TRUE      TRUE      TRUE      TRUE      TRUE

```

```
taxa_are_rows(TAX)
```

```
## NULL
```

```
any(duplicated(rownames(TAX)))
```

```
## [1] FALSE
```

```
which(duplicated(rownames(TAX)))
```

```
## integer(0)
```

```
#Rename so tree matches TAX file
```

```
taxa_names(TAX) <- gsub(taxa_names(TAX), pattern = "asv", replacement = "Seq")  
taxa_names(TAX)
```

```
##      [1] "Seq135"  "Seq441"  "Seq649"  "Seq1212" "Seq1847" "Seq2260"  
##      [7] "Seq3045" "Seq4205" "Seq9973" "Seq9651" "Seq140"  "Seq702"  
##     [13] "Seq1100" "Seq2151" "Seq10527" "Seq1582" "Seq143"  "Seq569"  
##     [19] "Seq710"  "Seq1918" "Seq2722"  "Seq464"  "Seq2440" "Seq6849"  
##     [25] "Seq717"  "Seq24"   "Seq211"   "Seq214"  "Seq217"  "Seq437"  
##     [31] "Seq439"  "Seq503"  "Seq561"   "Seq582"  "Seq666"  "Seq707"  
##     [37] "Seq738"  "Seq887"  "Seq1157"  "Seq1473" "Seq1557" "Seq2062"  
##     [43] "Seq3049" "Seq3124" "Seq5589"  "Seq2785" "Seq535"  "Seq5748"  
##     [49] "Seq8319" "Seq171"  "Seq784"   "Seq929"  "Seq1314" "Seq1841"  
##     [55] "Seq2222" "Seq2231" "Seq2386"  "Seq2519" "Seq2520" "Seq2964"  
##     [61] "Seq4503" "Seq10448" "Seq11805" "Seq48"   "Seq82"   "Seq93"  
##     [67] "Seq102"  "Seq176"  "Seq258"   "Seq311"  "Seq332"  "Seq359"  
##     [73] "Seq426"  "Seq869"  "Seq910"   "Seq982"  "Seq1004" "Seq1109"  
##     [79] "Seq1163" "Seq1227" "Seq1258"  "Seq1276" "Seq1416" "Seq1670"  
##     [85] "Seq1777" "Seq1851" "Seq1945"  "Seq2014" "Seq2119" "Seq2290"  
##     [91] "Seq2357" "Seq3123" "Seq3147"  "Seq4923" "Seq5105" "Seq8541"  
##     [97] "Seq8770" "Seq8771" "Seq9622"  "Seq10449" "Seq10496" "Seq10503"  
##    [103] "Seq2585" "Seq2356" "Seq494"   "Seq5498" "Seq6423"  "Seq8772"  
##    [109] "Seq9638" "Seq737"   "Seq1966"  "Seq1051" "Seq1129"  "Seq1574"  
##    [115] "Seq2557" "Seq2686" "Seq19"    "Seq114"  "Seq190"  "Seq204"  
##    [121] "Seq249"  "Seq297"   "Seq325"   "Seq354"  "Seq477"  "Seq663"  
##    [127] "Seq931"  "Seq1000"  "Seq1031"  "Seq1104" "Seq1199"  "Seq1259"  
##    [133] "Seq1406" "Seq1467"  "Seq1807"  "Seq2067" "Seq2323"  "Seq3208"  
##    [139] "Seq3404" "Seq5177"  "Seq5847"  "Seq7344" "Seq339"   "Seq456"  
##    [145] "Seq2783" "Seq349"   "Seq121"   "Seq834"  "Seq1446"  "Seq1563"  
##    [151] "Seq1649" "Seq1671"  "Seq1609"  "Seq1791" "Seq1906"  "Seq2007"  
##    [157] "Seq2203" "Seq2475"  "Seq2607"  "Seq2892" "Seq3052"  "Seq3430"  
##    [163] "Seq3666" "Seq4051"  "Seq4206"  "Seq5182" "Seq5504"  "Seq1871"  
##    [169] "Seq10504" "Seq139"   "Seq2503"  "Seq524"  "Seq11449" "Seq89"  
##    [175] "Seq858"  "Seq971"   "Seq1441"  "Seq2521" "Seq57"    "Seq97"  
##    [181] "Seq626"  "Seq763"   "Seq1043"  "Seq1115" "Seq1494"  "Seq1676"  
##    [187] "Seq1700" "Seq1740"  "Seq1822"  "Seq2047" "Seq1093"  "Seq183"  
##    [193] "Seq201"  "Seq3048"  "Seq8320"  "Seq10450" "Seq6160"  "Seq293"  
##    [199] "Seq510"  "Seq621"   "Seq2489"  "Seq7884" "Seq8559"  "Seq9473"  
##    [205] "Seq9935" "Seq9948"  "Seq10464" "Seq10490" "Seq10567" "Seq10604"  
##    [211] "Seq10586" "Seq10758" "Seq11853" "Seq1"    "Seq17"    "Seq13"  
##    [217] "Seq58"   "Seq72"    "Seq73"    "Seq141"  "Seq154"   "Seq199"  
##    [223] "Seq226"  "Seq239"   "Seq242"   "Seq363"  "Seq427"   "Seq525"  
##    [229] "Seq547"  "Seq568"   "Seq609"   "Seq672"  "Seq708"   "Seq716"  
##    [235] "Seq828"  "Seq853"   "Seq900"   "Seq1059" "Seq1280"  "Seq1370"  
##    [241] "Seq1431" "Seq1512"  "Seq1725"  "Seq1790" "Seq1810"  "Seq1872"  
##    [247] "Seq1889" "Seq1976"  "Seq2301"  "Seq2343" "Seq2813"  "Seq2993"  
##    [253] "Seq3210" "Seq3241"  "Seq3321"  "Seq3602" "Seq3601"  "Seq3781"  
##    [259] "Seq3903" "Seq4114"  "Seq4158"  "Seq4442" "Seq4563"  "Seq4564"  
##    [265] "Seq4636" "Seq5421"  "Seq5503"  "Seq6049" "Seq6162"  "Seq6550"
```

##	[271]	"Seq6989"	"Seq6999"	"Seq7354"	"Seq7521"	"Seq7890"	"Seq7893"
##	[277]	"Seq9184"	"Seq9657"	"Seq9664"	"Seq9936"	"Seq9939"	"Seq9952"
##	[283]	"Seq10432"	"Seq10438"	"Seq10443"	"Seq10442"	"Seq10477"	"Seq10491"
##	[289]	"Seq10492"	"Seq10556"	"Seq10578"	"Seq10576"	"Seq10577"	"Seq10593"
##	[295]	"Seq11826"	"Seq11847"	"Seq11850"	"Seq2565"	"Seq8331"	"Seq9405"
##	[301]	"Seq131"	"Seq376"	"Seq908"	"Seq916"	"Seq1937"	"Seq2342"
##	[307]	"Seq2941"	"Seq6691"	"Seq7512"	"Seq7889"	"Seq8778"	"Seq9938"
##	[313]	"Seq9953"	"Seq10462"	"Seq10582"	"Seq10884"	"Seq256"	"Seq319"
##	[319]	"Seq1546"	"Seq6548"	"Seq6848"	"Seq9956"	"Seq10560"	"Seq10564"
##	[325]	"Seq11860"	"Seq831"	"Seq8991"	"Seq10230"	"Seq3"	"Seq398"
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taxa_names(otu)
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## [11311] "Seq11311" "Seq11312" "Seq11313" "Seq11314" "Seq11315" "Seq11316"
## [11317] "Seq11317" "Seq11318" "Seq11319" "Seq11320" "Seq11321" "Seq11322"
## [11323] "Seq11323" "Seq11324" "Seq11325" "Seq11326" "Seq11327" "Seq11328"
## [11329] "Seq11329" "Seq11330" "Seq11331" "Seq11332" "Seq11333" "Seq11334"
## [11335] "Seq11335" "Seq11336" "Seq11337" "Seq11338" "Seq11339" "Seq11340"
## [11341] "Seq11341" "Seq11342" "Seq11343" "Seq11344" "Seq11345" "Seq11346"
## [11347] "Seq11347" "Seq11348" "Seq11349" "Seq11350" "Seq11351" "Seq11352"
## [11353] "Seq11353" "Seq11354" "Seq11355" "Seq11356" "Seq11357" "Seq11358"
## [11359] "Seq11359" "Seq11360" "Seq11361" "Seq11362" "Seq11363" "Seq11364"
## [11365] "Seq11365" "Seq11366" "Seq11367" "Seq11368" "Seq11369" "Seq11370"
## [11371] "Seq11371" "Seq11372" "Seq11373" "Seq11374"
```

```
##Merge all components into single phyloseq obj
```

```
ps_tax = phyloseq(otu, TAX, sam, tre)
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
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```

```
## Also defined by 'tidytree'
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
ps_tax
```

```
## phyloseq-class experiment-level object
## otu_table() OTU Table: [ 206 taxa and 416 samples ]
## sample_data() Sample Data: [ 416 samples by 21 sample variables ]
## tax_table() Taxonomy Table: [ 206 taxa by 2 taxonomic ranks ]
## phy_tree() Phylogenetic Tree: [ 206 tips and 204 internal nodes ]
```

```
#Remove samples less 1000 reads
```

```
ps1 = prune_samples(sample_sums(ps_tax) > 1000, ps_tax)
ps1
```

```
## phyloseq-class experiment-level object
## otu_table() OTU Table: [ 206 taxa and 338 samples ]
## sample_data() Sample Data: [ 338 samples by 21 sample variables ]
## tax_table() Taxonomy Table: [ 206 taxa by 2 taxonomic ranks ]
## phy_tree() Phylogenetic Tree: [ 206 tips and 204 internal nodes ]
```

```
#Remove taxa not seen more than 1 times in at least 5% of the samples
```

```
ps2 = filter_taxa(ps1, function(x) sum(x > 1) > (0.05*length(x)), TRUE)
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
ps2
```

```
## phyloseq-class experiment-level object
## otu_table() OTU Table: [ 206 taxa and 338 samples ]
## sample_data() Sample Data: [ 338 samples by 21 sample variables ]
## tax_table() Taxonomy Table: [ 206 taxa by 2 taxonomic ranks ]
## phy_tree() Phylogenetic Tree: [ 206 tips and 204 internal nodes ]
```

```
# keep only taxa that were observed at least twice
```

```
ps3 = prune_taxa(taxa_sums(ps2) >= 2, ps2)
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
ps3
```

```
## phyloseq-class experiment-level object
## otu_table() OTU Table: [ 206 taxa and 338 samples ]
## sample_data() Sample Data: [ 338 samples by 21 sample variables ]
## tax_table() Taxonomy Table: [ 206 taxa by 2 taxonomic ranks ]
## phy_tree() Phylogenetic Tree: [ 206 tips and 204 internal nodes ]
```

```

# remove taxonomy samples that were Ns

ps4 = subset_samples(ps3, Spec != "P_spp")

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Remove Fr Poly as ASVs all = 0

ps5 = subset_samples(ps4, Loc != "FrenPoly")

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Assign ASV numeric values to replace sequences
##n_seqs <- seq(ntaxa(ps5))
##len_n_seqs <- nchar(max(n_seqs))
##taxa_seqs <- taxa_names(ps5)
##asvs <- paste("ASV", formatC(n_seqs,
##width = len_n_seqs,
##flag = "0"), sep = "_")
##taxa_names(ps5) <- asvs

## remove samples with otu = 0
ps6 <- prune_samples(sample_sums(ps5) >= 1, ps5)

```

```
##dfASV_seq <- data.frame(asv=asvs, seq=taxa_seqs, stringsAsFactors = FALSE)
##write.csv(dfASV_seq, file="dfASV_seq.csv", row.names = FALSE)
##write.fasta(as.list(taxa_seqs), asvs, "asv_seq.fasta", open = "w", nbchar = 60, as.string =TRUE)

##saveRDS(dfASV_seq, file="dfASV_Seq.rds")
```

```
## Remove singletons
ps6_filt <- filter_taxa(ps6, function(x) sum(x > 1) > 1, TRUE)
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
ps6_filt
```

```
## phyloseq-class experiment-level object
## otu_table() OTU Table: [ 206 taxa and 338 samples ]
## sample_data() Sample Data: [ 338 samples by 21 sample variables ]
## tax_table() Taxonomy Table: [ 206 taxa by 2 taxonomic ranks ]
## phy_tree() Phylogenetic Tree: [ 206 tips and 204 internal nodes ]
```

```
## CSS transformation
```

```
ps6_filt_css <- phyloseq_transform_css(ps6_filt, norm = TRUE, log = FALSE)
```

```
## Loading required namespace: metagenomeSeq
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
ps_normalized <- list()
normalization <- 'css'
ps_normalized[[normalization]] <- ps6_filt_css
ps_normalized[[normalization]]
```



```
## phyloseq-class experiment-level object
## otu_table() OTU Table: [ 206 taxa and 338 samples ]
## sample_data() Sample Data: [ 338 samples by 21 sample variables ]
## tax_table() Taxonomy Table: [ 206 taxa by 2 taxonomic ranks ]
## phy_tree() Phylogenetic Tree: [ 206 tips and 204 internal nodes ]
```

```
colnames(sample_data(ps6_filt_css))
```

```
## [1] "Loc"      "Yr"      "Spec"    "Exp_cond" "Code"
## [6] "Repro"    "Month"   "Season"  "S_region" "L_region"
## [11] "Exact.date" "Tbl_bin" "T_bleach" "DHW"      "DHW_cat"
## [16] "SST_a"    "Coord_X" "Coord_Y" "Primer"   "Pub"
## [21] "Note"
```

```
saveRDS(ps6_filt_css, file="ps6_filt_css.rds")
```

```
## Set random seed for reproducibility
```

```
set.seed(8765)
```

```
##Alpha div
```

```
#Remove Panama
```

```
ps7 <- subset_samples(ps6_filt_css, Loc != "Panam")
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
#Remove P. me
```

```
ps8 <- subset_samples(ps7, Spec != "P_me")
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```
## Also defined by 'tidytree'
```

```
## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
```

```

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

ps9 = subset_samples(ps8, Spec == "P_dam")

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

ps10 = subset_samples(ps9, Loc != "Aus_GBR_Heron")

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

ps11 = subset_samples(ps10, Season != "Summer")

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

```

```

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

ps12 = subset_samples(ps11, Tbl_bin != "Bleaching")

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

ps13 = subset_samples(ps12, Loc != "NewCal")

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'
## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

```

```
ps13
```

```
## phyloseq-class experiment-level object
## otu_table() OTU Table: [ 206 taxa and 91 samples ]
## sample_data() Sample Data: [ 91 samples by 21 sample variables ]
## tax_table() Taxonomy Table: [ 206 taxa by 2 taxonomic ranks ]
## phy_tree() Phylogenetic Tree: [ 206 tips and 204 internal nodes ]
```

```
colnames(sample_data(ps13))
```

```
## [1] "Loc"      "Yr"      "Spec"    "Exp_cond" "Code"
## [6] "Repro"    "Month"   "Season"  "S_region" "L_region"
## [11] "Exact.date" "Tbl_bin" "T_bleach" "DHW"      "DHW_cat"
## [16] "SST_a"    "Coord_X" "Coord_Y" "Primer"   "Pub"
## [21] "Note"
```

```
head(sample_data(ps13))
```

```
##      Loc   Yr  Spec Exp_cond Code  Repro Month Season S_region L_region
## SRR5963024 Oman 2014 P_dam    31C  Om2    B  June Winter IndianOc IndianOc
## SRR5963025 Oman 2014 P_dam    31C  Om2    B  June Winter IndianOc IndianOc
## SRR5963026 Oman 2014 P_dam    31C  Om3    B  June Winter IndianOc IndianOc
## SRR5963027 Oman 2014 P_dam    31C  Om2    B  June Winter IndianOc IndianOc
## SRR5963028 Oman 2014 P_dam    31C  Om3    B  June Winter IndianOc IndianOc
## SRR5963029 Oman 2014 P_dam    31C  Om3    B  June Winter IndianOc IndianOc
##      Exact.date Tbl_bin T_bleach DHW DHW_cat SST_a Coord_X Coord_Y
## SRR5963024      <NA>   Long    15y 4.24    Mod  30.8   23.52   58.74
## SRR5963025      <NA>   Long    15y 4.24    Mod  30.8   23.52   58.74
## SRR5963026      <NA>   Long    15y 3.79    Mod  30.8   23.62   58.60
## SRR5963027      <NA>   Long    15y 4.24    Mod  30.8   23.52   58.74
## SRR5963028      <NA>   Long    15y 3.79    Mod  30.8   23.62   58.60
## SRR5963029      <NA>   Long    15y 3.79    Mod  30.8   23.62   58.60
##      Primer
## SRR5963024 ITS-DINO https://www.biorxiv.org/content/10.1101/398602v4.full.pdf
## SRR5963025 ITS-DINO https://www.biorxiv.org/content/10.1101/398602v4.full.pdf
## SRR5963026 ITS-DINO https://www.biorxiv.org/content/10.1101/398602v4.full.pdf
## SRR5963027 ITS-DINO https://www.biorxiv.org/content/10.1101/398602v4.full.pdf
## SRR5963028 ITS-DINO https://www.biorxiv.org/content/10.1101/398602v4.full.pdf
## SRR5963029 ITS-DINO https://www.biorxiv.org/content/10.1101/398602v4.full.pdf
##
## SRR5963024 Colonies said to be "Pocillopora damicornis-like"; based on ORF and microsatellites, all
## SRR5963025 Colonies said to be "Pocillopora damicornis-like"; based on ORF and microsatellites, all
## SRR5963026 Colonies said to be "Pocillopora damicornis-like"; based on ORF and microsatellites, all
## SRR5963027 Colonies said to be "Pocillopora damicornis-like"; based on ORF and microsatellites, all
## SRR5963028 Colonies said to be "Pocillopora damicornis-like"; based on ORF and microsatellites, all
## SRR5963029 Colonies said to be "Pocillopora damicornis-like"; based on ORF and microsatellites, all
```

```
library(ggtree)
```

```
## ggtree v3.0.4 For help: https://yulab-smu.top/treedata-book/
##
```

```
## If you use ggtree in published research, please cite the most appropriate paper(s):
##
## 1. Guangchuang Yu. Using ggtree to visualize data on tree-like structures. Current Protocols in Bioinformatics
## 2. Guangchuang Yu, Tommy Tsan-Yuk Lam, Huachen Zhu, Yi Guan. Two methods for mapping and visualizing phylogenetic trees
## 3. Guangchuang Yu, David Smith, Huachen Zhu, Yi Guan, Tommy Tsan-Yuk Lam. ggtree: an R package for visualizing phylogenetic trees

##
## Attaching package: 'ggtree'

## The following object is masked from 'package:randomForest':
##
##     margin

## The following object is masked from 'package:magrittr':
##
##     inset

## The following object is masked from 'package:tidyr':
##
##     expand
```

```
#Merge samples for abundance plots by species
```

```
HSmerge <- merge_samples(ps13, "Spec")
```

```
## Warning in asMethod(object): NAs introduced by coercion
## Warning in asMethod(object): NAs introduced by coercion
## Warning in asMethod(object): NAs introduced by coercion
## Warning in asMethod(object): NAs introduced by coercion
## Warning in asMethod(object): NAs introduced by coercion
## Warning in asMethod(object): NAs introduced by coercion
## Warning in asMethod(object): NAs introduced by coercion
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## Warning in asMethod(object): NAs introduced by coercion
## Warning in asMethod(object): NAs introduced by coercion
## Warning in asMethod(object): NAs introduced by coercion
## Warning in asMethod(object): NAs introduced by coercion
```

```

## Warning in asMethod(object): NAs introduced by coercion
## Warning in asMethod(object): NAs introduced by coercion

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

## Also defined by 'tidytree'

## Found more than one class "phylo" in cache; using the first, from namespace 'phyloseq'

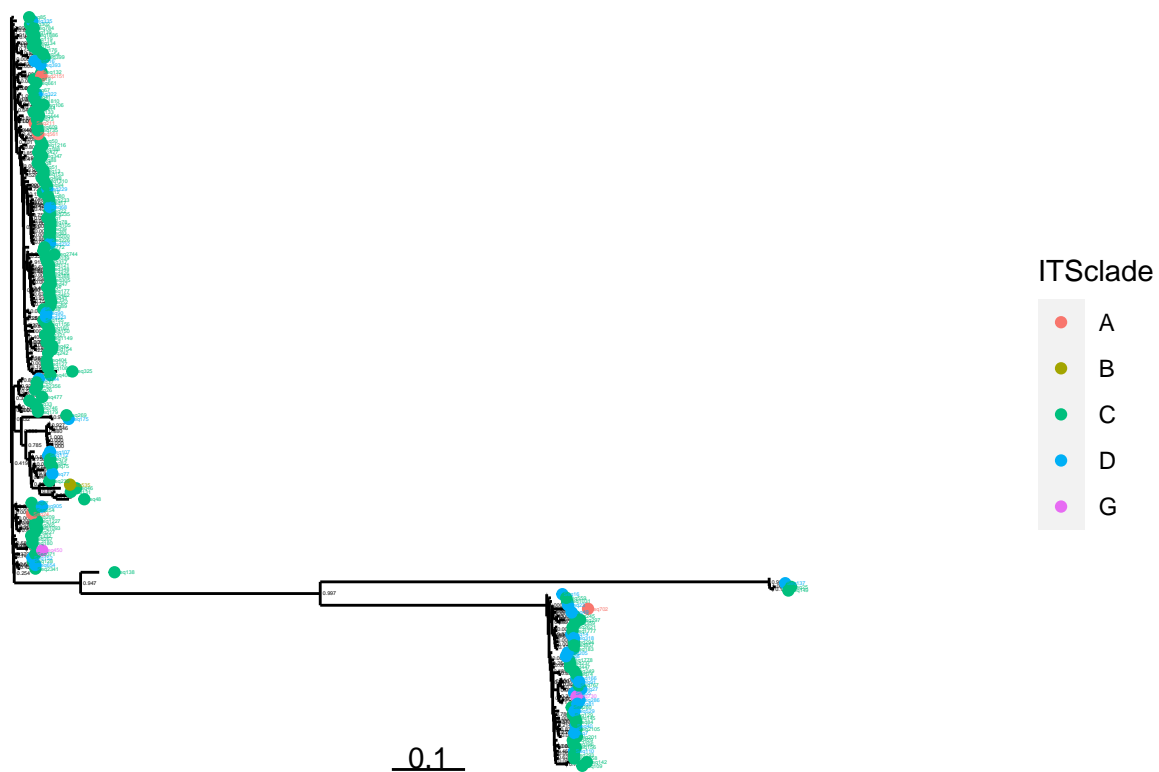
## Also defined by 'tidytree'

##Phylogenetic tree by clade

itsc_tree <- plot_tree(HSmerge, color="ITScLade", ladderize="right", label.tips="taxa_names") + geom_tr
itsc_tree

## Warning: Removed 3 rows containing missing values (geom_segment).

## Warning: Removed 1 rows containing missing values (geom_segment).
```

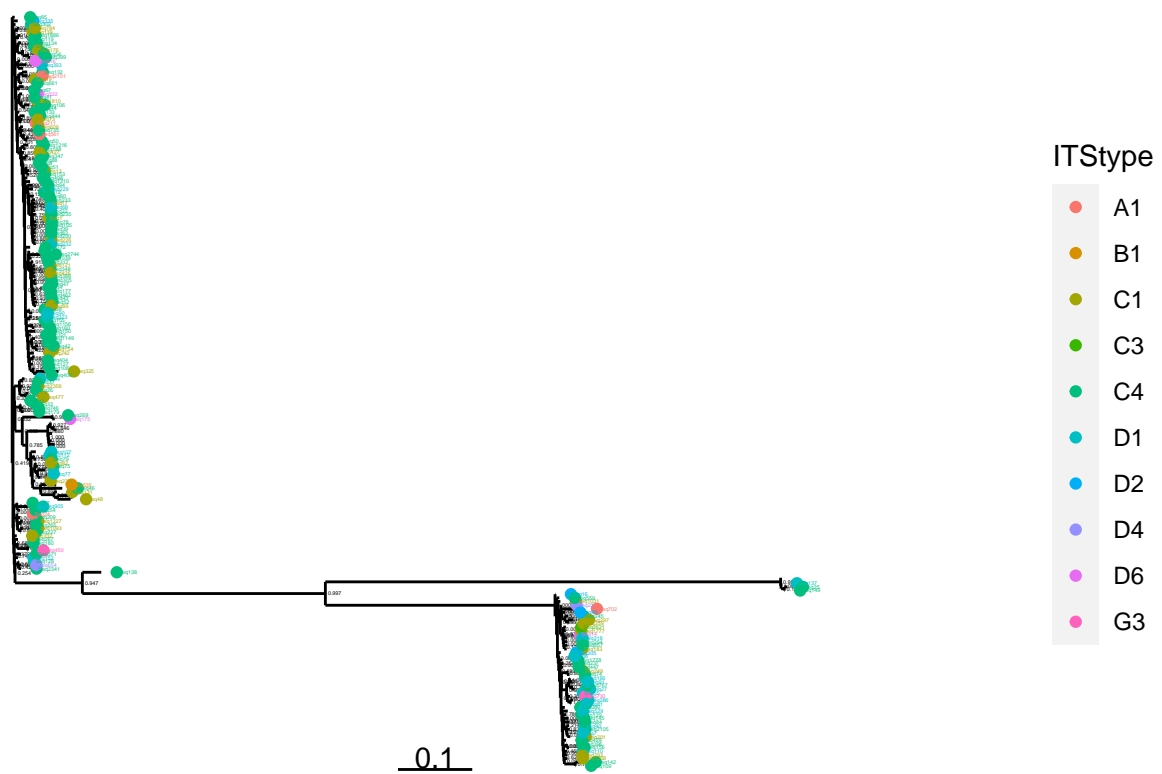


```
##Phylogenetic tree by type
```

```
itst_tree <- plot_tree(HSmerge, color="ITStype", ladderize="right", label.tips="taxa_names") + geom_treescale(0.1)
itst_tree
```

```
## Warning: Removed 3 rows containing missing values (geom_segment).
```

```
## Warning: Removed 1 rows containing missing values (geom_segment).
```



```
ggsave("Phylotree_SYMPORTAL_ITScnade_1Nov2021.pdf")
```

```
## Saving 6.5 x 4.5 in image
```

```
## Warning: Removed 3 rows containing missing values (geom_segment).
```

```
## Warning: Removed 1 rows containing missing values (geom_segment).
```