Final AFB phylogeny analysis

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Load libraries

```
#BiocManager::install("Rcpi")
library(devtools)
```

```
## Loading required package: usethis
```

```
library(phangorn)
```

```
## Loading required package: ape
```

```
library(ggtree)
```

```
## Registered S3 methods overwritten by 'treeio':
##   method               from
##   MRCA.phylo           tidytree
##   MRCA.treedata        tidytree
##   Nnode.treedata       tidytree
##   Ntip.treedata        tidytree
##   ancestor.phylo       tidytree
##   ancestor.treedata    tidytree
##   child.phylo          tidytree
##   child.treedata       tidytree
##   full_join.phylo      tidytree
##   full_join.treedata   tidytree
##   groupClade.phylo     tidytree
##   groupClade.treedata  tidytree
##   groupOTU.phylo       tidytree
##   groupOTU.treedata    tidytree
##   inner_join.phylo     tidytree
##   inner_join.treedata  tidytree
##   is.rooted.treedata   tidytree
##   nodeid.phylo         tidytree
##   nodeid.treedata      tidytree
##   nodelab.phylo        tidytree
##   nodelab.treedata     tidytree
##   offspring.phylo      tidytree
##   offspring.treedata   tidytree
##   parent.phylo         tidytree
##   parent.treedata      tidytree
##   root.treedata        tidytree
##   rootnode.phylo       tidytree
##   sibling.phylo        tidytree
```

```
## ggtree v3.8.2 For help: https://yulab-smu.top/treedata-book/
##
## If you use the ggtree package suite in published research, please cite
## the appropriate paper(s):
##
## Guangchuang Yu, David Smith, Huachen Zhu, Yi Guan, Tommy Tsan-Yuk Lam.
## ggtree: an R package for visualization and annotation of phylogenetic
## trees with their covariates and other associated data. Methods in
## Ecology and Evolution. 2017, 8(1):28-36. doi:10.1111/2041-210X.12628
##
## Shuangbin Xu, Lin Li, Xiao Luo, Meijun Chen, Wenli Tang, Li Zhan, Zehan
## Dai, Tommy T. Lam, Yi Guan, Guangchuang Yu. Ggtree: A serialized data
## object for visualization of a phylogenetic tree and annotation data.
## iMeta 2022, 1(4):e56. doi:10.1002/imt2.56
##
## Guangchuang Yu. Using ggtree to visualize data on tree-like structures.
## Current Protocols in Bioinformatics. 2020, 69:e96. doi:10.1002/cpbi.96

##
## Attaching package: 'ggtree'

## The following object is masked from 'package:ape':
##
##     rotate
```

```
library(treeio)
```

```
## treeio v1.24.3 For help: https://yulab-smu.top/treedata-book/
##
## If you use the ggtree package suite in published research, please cite
## the appropriate paper(s):
##
## 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 Jiang, G Yu. treeio: an R package
## for phylogenetic tree input and output with richly annotated and
## associated data. Molecular Biology and Evolution. 2020, 37(2):599-603.
## doi: 10.1093/molbev/msz240
##
## Guangchuang Yu.  Data Integration, Manipulation and Visualization of
## Phylogenetic Trees (1st edition). Chapman and Hall/CRC. 2022,
## doi:10.1201/9781003279242
##
## Guangchuang Yu. Using ggtree to visualize data on tree-like structures.
## Current Protocols in Bioinformatics. 2020, 69:e96. doi:10.1002/cpbi.96

##
## Attaching package: 'treeio'

## The following object is masked from 'package:ape':
##
##     drop.tip
```

```
library(ggplot2)
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.3     v readr     2.1.4
```

```
## v forcats   1.0.0     v stringr   1.5.0
## v lubridate 1.9.2     v tibble    3.2.1
## v purrr     1.0.2     v tidyr     1.3.0
## -- Conflicts ---------------------------------------- tidyverse_conflicts() --
## x tidyr::expand() masks ggtree::expand()
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## x dplyr::where()  masks ape::where()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(BSgenome)
```

```
## Loading required package: BiocGenerics
##
## Attaching package: 'BiocGenerics'
##
## The following objects are masked from 'package:lubridate':
##
##     intersect, setdiff, union
##
## The following objects are masked from 'package:dplyr':
##
##     combine, intersect, setdiff, union
##
## The following objects are masked from 'package:stats':
##
##     IQR, mad, sd, var, xtabs
##
## The following objects are masked from 'package:base':
##
##     anyDuplicated, aperm, append, as.data.frame, basename, cbind,
##     colnames, dirname, do.call, duplicated, eval, evalq, Filter, Find,
##     get, grep, grepl, intersect, is.unsorted, lapply, Map, mapply,
##     match, mget, order, paste, pmax, pmax.int, pmin, pmin.int,
##     Position, rank, rbind, Reduce, rownames, sapply, setdiff, sort,
##     table, tapply, union, unique, unsplit, which.max, which.min
##
## Loading required package: S4Vectors
## Loading required package: stats4
##
## Attaching package: 'S4Vectors'
##
## The following objects are masked from 'package:lubridate':
##
##     second, second<-
##
## The following objects are masked from 'package:dplyr':
##
##     first, rename
##
## The following object is masked from 'package:tidyr':
##
##     expand
##
```

```
## The following object is masked from 'package:ggtree':
##
##     expand
##
## The following object is masked from 'package:utils':
##
##     findMatches
##
## The following objects are masked from 'package:base':
##
##     expand.grid, I, unname
##
## Loading required package: IRanges
##
## Attaching package: 'IRanges'
##
## The following object is masked from 'package:lubridate':
##
##     %within%
##
## The following objects are masked from 'package:dplyr':
##
##     collapse, desc, slice
##
## The following object is masked from 'package:purrr':
##
##     reduce
##
## The following object is masked from 'package:ggtree':
##
##     collapse
##
## Loading required package: GenomeInfoDb
## Loading required package: GenomicRanges
## Loading required package: Biostrings
## Loading required package: XVector
##
## Attaching package: 'XVector'
##
## The following object is masked from 'package:purrr':
##
##     compact
##
##
## Attaching package: 'Biostrings'
##
## The following object is masked from 'package:treeio':
##
##     mask
##
## The following object is masked from 'package:ape':
##
##     complement
##
```

```
## The following object is masked from 'package:base':
##
##     strsplit
##
## Loading required package: rtracklayer
```

```
library(Biostrings)
library(XVector)
library(rtracklayer)
library(GenomicFeatures)
```

```
## Loading required package: AnnotationDbi
## Loading required package: Biobase
## Welcome to Bioconductor
##
##     Vignettes contain introductory material; view with
##     'browseVignettes()'. To cite Bioconductor, see
##     'citation("Biobase")', and for packages 'citation("pkgname")'.
##
##
## Attaching package: 'AnnotationDbi'
##
## The following object is masked from 'package:dplyr':
##
##     select
```

```
library(biomaRt)
library(ape)
library(DECIPHER)
```

```
## Loading required package: RSQLite
## Loading required package: parallel
```

```
library(Rcpi)
```

```
##
```

From Previous analysis

```
setwd("~/GitHub/SoyArcs_manuscript/final_trees/")

GmAFB <- Biostrings::readAAStringSet(filepath = "AFB_input/GmAFB.fasta")
unique(GmAFB)
```

```
## AAStringSet object of length 19:
##      width seq                                               names
##  [1]   573 MMNYFPDEVIEHIFDYVVSHSDR...MYLYRTLAGKRKDAPEYVWTL* Glyma.16G050500|G...
##  [2]   574 MNCFPDEVIGHIFGCVTSQRDRN...MYLYRTLAGRRKDAPELVWTL* Glyma.16G146400|G...
##  [3]   584 MNQIDDGRTLSPLPDQVLENVLE...YMYRSLDRPRDDAPKVVTILC* Glyma.04G093500|G...
##  [4]   574 MNFFPDEVIEHIFDYVTSQRDRN...TYLYRTLVGRRKDAPEHVWTL* Glyma.02G065300|G...
##  [5]   631 MRDKSESHPSTNSEDDHRSSPLL...YMYRSLDGPRDDAPRFVTILQ* Glyma.02G211800|G...
##  ...   ... ...
## [15]   588 MKQIDDGDDEQRSLSPLPEQVLE...YMYRSLDGPRDDAPKVVTILC* Glyma.06G095400|G...
## [16]   587 MQKMAYTFSFPEEVLEHVFSFIW...PRLDMPGFVWTMEDDSSLRLE* Glyma.03G209400|G...
## [17]   573 MMNYFPDEVIEHIFDYVVSHSDR...MYLYRTLAGKRKDAPEYVWTL* Glyma.19G100200|G...
## [18]   588 MQRMAYTFSFPEEVLEHVFSFIW...PRLDMPGFVWTMEDDSSLRLE* Glyma.19G206800|G...
## [19]   591 MTEERNVRKTRVVDVVLDCVIPY...GQRSDFPDTVVPLDTATCVDT* Glyma.18G030200|G...
```

```
names(GmAFB)
```

```
##  [1] "Glyma.16G050500|Glyma.16G050500.1" "Glyma.16G146400|Glyma.16G146400.1"
##  [3] "Glyma.04G093500|Glyma.04G093500.1" "Glyma.02G065300|Glyma.02G065300.1"
##  [5] "Glyma.02G211800|Glyma.02G211800.1" "Glyma.02G254300|Glyma.02G254300.1"
##  [7] "Glyma.02G152800|Glyma.02G152800.2" "Glyma.02G152800|Glyma.02G152800.3"
##  [9] "Glyma.10G021500|Glyma.10G021500.2" "Glyma.08G059500|Glyma.08G059500.6"
## [11] "Glyma.07G189800|Glyma.07G189800.5" "Glyma.11G227300|Glyma.11G227300.1"
## [13] "Glyma.14G179500|Glyma.14G179500.1" "Glyma.14G062100|Glyma.14G062100.1"
## [15] "Glyma.06G095400|Glyma.06G095400.1" "Glyma.03G209400|Glyma.03G209400.1"
## [17] "Glyma.19G100200|Glyma.19G100200.1" "Glyma.19G206800|Glyma.19G206800.1"
## [19] "Glyma.18G030200|Glyma.18G030200.1"
```

```
phylotools::rm.sequence.fasta(infile = "AFB_input/GmAFB.fasta", to.rm = "Glyma.02G152800|Glyma.02G15280
```

```
## AFB_input/GmAFB_removed.fasta has been saved to  /Users/deisianyneres/GitHub/SoyArcs_manuscript/final
```

```
GmAFB <- Biostrings::readAAStringSet(filepath = "AFB_input/GmAFB_removed.fasta")
unique(GmAFB)
```

```
## AAStringSet object of length 18:
##      width seq                                               names
##  [1]   573 MMNYFPDEVIEHIFDYVVSHSDR...MYLYRTLAGKRKDAPEYVWTL* Glyma.16G050500|G...
##  [2]   574 MNCFPDEVIGHIFGCVTSQRDRN...MYLYRTLAGRRKDAPELVWTL* Glyma.16G146400|G...
##  [3]   584 MNQIDDGRTLSPLPDQVLENVLE...YMYRSLDRPRDDAPKVVTILC* Glyma.04G093500|G...
##  [4]   574 MNFFPDEVIEHIFDYVTSQRDRN...TYLYRTLVGRRKDAPEHVWTL* Glyma.02G065300|G...
##  [5]   631 MRDKSESHPSTNSEDDHRSSPLL...YMYRSLDGPRDDAPRFVTILQ* Glyma.02G211800|G...
##  ...   ... ...
## [14]   588 MKQIDDGDDEQRSLSPLPEQVLE...YMYRSLDGPRDDAPKVVTILC* Glyma.06G095400|G...
## [15]   587 MQKMAYTFSFPEEVLEHVFSFIW...PRLDMPGFVWTMEDDSSLRLE* Glyma.03G209400|G...
## [16]   573 MMNYFPDEVIEHIFDYVVSHSDR...MYLYRTLAGKRKDAPEYVWTL* Glyma.19G100200|G...
## [17]   588 MQRMAYTFSFPEEVLEHVFSFIW...PRLDMPGFVWTMEDDSSLRLE* Glyma.19G206800|G...
## [18]   591 MTEERNVRKTRVVDVVLDCVIPY...GQRSDFPDTVVPLDTATCVDT* Glyma.18G030200|G...
```

```
head(GmAFB, n = 10)
```

```
## AAStringSet object of length 10:
##      width seq                                               names
##  [1]   573 MMNYFPDEVIEHIFDYVVSHSDR...MYLYRTLAGKRKDAPEYVWTL* Glyma.16G050500|G...
##  [2]   574 MNCFPDEVIGHIFGCVTSQRDRN...MYLYRTLAGRRKDAPELVWTL* Glyma.16G146400|G...
##  [3]   584 MNQIDDGRTLSPLPDQVLENVLE...YMYRSLDRPRDDAPKVVTILC* Glyma.04G093500|G...
##  [4]   574 MNFFPDEVIEHIFDYVTSQRDRN...TYLYRTLVGRRKDAPEHVWTL* Glyma.02G065300|G...
##  [5]   631 MRDKSESHPSTNSEDDHRSSPLL...YMYRSLDGPRDDAPRFVTILQ* Glyma.02G211800|G...
##  [6]   585 MTARRLSDVVLDCVMPYIHDSKD...GPRTDFPDTVIPLDPGTYVDT* Glyma.02G254300|G...
##  [7]   586 MRPRVAYSFPEEVLEHVFSFIEC...PRLDMPGYVWRMQDDSALRIS* Glyma.02G152800|G...
##  [8]   586 MRPRVNYSFPEEVLEHVFSFIEC...PRLDMPGYVWRMQDDSALRIS* Glyma.10G021500|G...
##  [9]   580 MMECRRKKENQNPNSTFPDEVLE...VYVYRSVAGPRRDAPPFVLTL* Glyma.08G059500|G...
## [10]   579 MECRRKKENQKSNSTFPDEVLER...VYVYRSVAGPRRDAPPFVLTL* Glyma.07G189800|G...
```

```
tail(GmAFB, n=10)
```

```
## AAStringSet object of length 10:
##      width seq                                               names
##  [1]   580 MMECRRKKENQNPNSTFPDEVLE...VYVYRSVAGPRRDAPPFVLTL* Glyma.08G059500|G...
##  [2]   579 MECRRKKENQKSNSTFPDEVLER...VYVYRSVAGPRRDAPPFVLTL* Glyma.07G189800|G...
##  [3]   591 MTEDRNVRKTRVVDLVLDCVIPY...GQRSDFPDTVVPLDTATCVDT* Glyma.11G227300|G...
##  [4]   641 MREKENHPSTNSEDDHRSSLLDL...YMYRSLDGPRDDAPRFVTILQ* Glyma.14G179500|G...
```

```
##  [5]   592 MEDRDAKRMATRLSDVVLDCVMP...GPRTDFPDTVIPLDPATYVDT* Glyma.14G062100|G...
##  [6]   588 MKQIDDGDDEQRSLSPLPEQVLE...YMYRSLDGPRDDAPKVVTILC* Glyma.06G095400|G...
##  [7]   587 MQKMAYTFSFPEEVLEHVFSFIW...PRLDMPGFVWTMEDDSSLRLE* Glyma.03G209400|G...
##  [8]   573 MMNYFPDEVIEHIFDYVVSHSDR...MYLYRTLAGKRKDAPEYVWTL* Glyma.19G100200|G...
##  [9]   588 MQRMAYTFSFPEEVLEHVFSFIW...PRLDMPGFVWTMEDDSSLRLE* Glyma.19G206800|G...
## [10]   591 MTEERNVRKTRVVDVVLDCVIPY...GQRSDFPDTVVPLDTATCVDT* Glyma.18G030200|G...
```

```
# make alignment
(AFB_aligned <- DECIPHER::AlignSeqs(GmAFB))
```

```
## Determining distance matrix based on shared 5-mers:
## ================================================================================
##
## Time difference of 0.02 secs
##
## Clustering into groups by similarity:
## ================================================================================
##
## Time difference of 0.01 secs
##
## Aligning Sequences:
## ================================================================================
##
## Time difference of 0.27 secs
##
## Iteration 1 of 2:
##
## Determining distance matrix based on alignment:
## ================================================================================
##
## Time difference of 0 secs
##
## Reclustering into groups by similarity:
## ================================================================================
##
## Time difference of 0.01 secs
##
## Realigning Sequences:
## ================================================================================
##
## Time difference of 0.01 secs
##
## Alignment converged - skipping remaining iteration.
```

```
## AAStringSet object of length 18:
##      width seq                                               names
##  [1]   670 ----------------------...KRKDAPEYVWTL---------* Glyma.16G050500|G...
##  [2]   670 ----------------------...RRKDAPELVWTL---------* Glyma.16G146400|G...
##  [3]   670 ----------------------...PRDDAPKVVTIL--------C* Glyma.04G093500|G...
##  [4]   670 ----------------------...RRKDAPEHVWTL---------* Glyma.02G065300|G...
##  [5]   670 ---MRDKSESHPSTNSEDDHRSS...PRDDAPRFVTIL--------Q* Glyma.02G211800|G...
##  ...   ... ...
## [14]   670 ----------------------...PRDDAPKVVTIL--------C* Glyma.06G095400|G...
## [15]   670 ----------------------...PRLDMPGFVWTMEDDSSLRLE* Glyma.03G209400|G...
## [16]   670 ----------------------...KRKDAPEYVWTL---------* Glyma.19G100200|G...
```

```
## [17]   670 ----------------------...PRLDMPGFVWTMEDDSSLRLE* Glyma.19G206800|G...
## [18]   670 ----------------------...QRSDFPDTVVPLDTATCVD-T* Glyma.18G030200|G...
```

```
# Fix names, because characters such as | are not accepted in MrBayes
names(AFB_aligned) <- stringr::str_remove(names(AFB_aligned), ".*\\|") # remove everything before .*\\

# write.csv(names(AFB_aligned), "AFB_IDs_all.csv")

# CUt low alignment regions by masking alignment
(AFB_masked <- DECIPHER::MaskAlignment(AFB_aligned,
              type = "sequences",
              windowSize = 6, # same as aliscore default value.
              threshold = 1,
              maxFractionGaps = 0.2,
              includeTerminalGaps = FALSE,
              correction = FALSE,
              showPlot = FALSE))
```

```
## AAMultipleAlignment with 18 rows and 670 columns
##       aln                                                  names
##  [1] -----####################...LAGKRKDAPEYVWTL#########* Glyma.16G050500.1
##  [2] -----####################...LAGRRKDAPELVWTL#########* Glyma.16G146400.1
##  [3] -----####################...LDRPRDDAPKVVTIL#########* Glyma.04G093500.1
##  [4] -----####################...LVGRRKDAPEHVWTL#########* Glyma.02G065300.1
##  [5] ---MR####################...LDGPRDDAPRFVTIL#########* Glyma.02G211800.1
##  [6] -----####################...LAGPRTDFPDTVIPL#########* Glyma.02G254300.1
##  [7] -----####################...VSGPRLDMPGYVWRM#########* Glyma.02G152800.2
##  [8] -----####################...VSGPRLDMPGYVWRM#########* Glyma.10G021500.2
##  [9] MMECR####################...VAGPRRDAPPFVLTL#########* Glyma.08G059500.6
## [10] -MECR####################...VAGPRRDAPPFVLTL#########* Glyma.07G189800.5
## [11] -----####################...LAGQRSDFPDTVVPL#########* Glyma.11G227300.1
## [12] ---MR####################...LDGPRDDAPRFVTIL#########* Glyma.14G179500.1
## [13] -----####################...LAGPRTDFPDTVIPL#########* Glyma.14G062100.1
## [14] -----####################...LDGPRDDAPKVVTIL#########* Glyma.06G095400.1
## [15] -----####################...VAGPRLDMPGFVWTM#########* Glyma.03G209400.1
## [16] -----####################...LAGKRKDAPEYVWTL#########* Glyma.19G100200.1
## [17] -----####################...IAGPRLDMPGFVWTM#########* Glyma.19G206800.1
## [18] -----####################...LAGQRSDFPDTVVPL#########* Glyma.18G030200.1
```

```
# make it a AAStringSet
AAstr_AFB <- as(AFB_masked, "AAStringSet")
BrowseSeqs(AAstr_AFB) # A few sequences seems really small, however I believe they will probably be dro

writeXStringSet(AAstr_AFB, file="AFB_input//masked_AFB.fasta" )

#Create a matrix so we can create the nexus file next
(matrix_AFB <- as.matrix(AAstr_AFB, use.names=TRUE))
```

```
##                   [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11]
## Glyma.16G050500.1 "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"   "-"
## Glyma.16G146400.1 "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"   "-"
## Glyma.04G093500.1 "-"  "-"  "-"  "-"  "-"  "-"  "-"  "R"  "T"  "L"   "S"
## Glyma.02G065300.1 "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"   "-"
## Glyma.02G211800.1 "-"  "-"  "-"  "M"  "R"  "P"  "S"  "E"  "P"  "Q"   "A"
## Glyma.02G254300.1 "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"   "-"
## Glyma.02G152800.2 "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "M"  "R"   "P"
```

```
## Glyma.10G021500.2 "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "M"  "R"   "P"
## Glyma.08G059500.6 "M"  "M"  "E"  "C"  "R"  "R"  "K"  "K"  "E"  "N"   "Q"
## Glyma.07G189800.5 "-"  "M"  "E"  "C"  "R"  "R"  "K"  "K"  "E"  "N"   "Q"
## Glyma.11G227300.1 "-"  "-"  "-"  "-"  "-"  "M"  "T"  "E"  "D"  "R"   "N"
## Glyma.14G179500.1 "-"  "-"  "-"  "M"  "R"  "T"  "S"  "E"  "P"  "Q"   "A"
## Glyma.14G062100.1 "-"  "-"  "-"  "-"  "-"  "E"  "D"  "R"  "D"  "A"   "K"
## Glyma.06G095400.1 "-"  "-"  "-"  "-"  "-"  "E"  "Q"  "R"  "S"  "L"   "S"
## Glyma.03G209400.1 "-"  "-"  "-"  "-"  "-"  "-"  "-"  "M"  "Q"  "K"   "M"
## Glyma.19G100200.1 "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"  "-"   "-"
## Glyma.19G206800.1 "-"  "-"  "-"  "-"  "-"  "-"  "-"  "M"  "Q"  "R"   "M"
## Glyma.18G030200.1 "-"  "-"  "-"  "-"  "-"  "M"  "T"  "E"  "E"  "R"   "N"
##                   [,12] [,13] [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21]
## Glyma.16G050500.1 "-"   "M"   "M"   "N"   "Y"   "F"   "P"   "D"   "E"   "V"
## Glyma.16G146400.1 "-"   "-"   "M"   "N"   "C"   "F"   "P"   "D"   "E"   "V"
## Glyma.04G093500.1 "P"   "L"   "P"   "D"   "Q"   "V"   "L"   "E"   "N"   "V"
## Glyma.02G065300.1 "-"   "-"   "M"   "N"   "F"   "F"   "P"   "D"   "E"   "V"
## Glyma.02G211800.1 "P"   "F"   "P"   "D"   "Q"   "V"   "L"   "E"   "N"   "V"
## Glyma.02G254300.1 "M"   "T"   "A"   "R"   "R"   "L"   "S"   "D"   "V"   "V"
## Glyma.02G152800.2 "R"   "V"   "A"   "Y"   "S"   "F"   "P"   "E"   "E"   "V"
## Glyma.10G021500.2 "R"   "V"   "N"   "Y"   "S"   "F"   "P"   "E"   "E"   "V"
## Glyma.08G059500.6 "N"   "P"   "N"   "S"   "T"   "F"   "P"   "D"   "E"   "V"
## Glyma.07G189800.5 "K"   "S"   "N"   "S"   "T"   "F"   "P"   "D"   "E"   "V"
## Glyma.11G227300.1 "V"   "R"   "K"   "T"   "R"   "V"   "V"   "D"   "L"   "V"
## Glyma.14G179500.1 "P"   "F"   "P"   "D"   "Q"   "V"   "L"   "E"   "N"   "V"
## Glyma.14G062100.1 "R"   "M"   "A"   "T"   "R"   "L"   "S"   "D"   "V"   "V"
## Glyma.06G095400.1 "P"   "L"   "P"   "E"   "Q"   "V"   "L"   "E"   "N"   "V"
## Glyma.03G209400.1 "A"   "Y"   "T"   "F"   "S"   "F"   "P"   "E"   "E"   "V"
## Glyma.19G100200.1 "-"   "M"   "M"   "N"   "Y"   "F"   "P"   "D"   "E"   "V"
## Glyma.19G206800.1 "A"   "Y"   "T"   "F"   "S"   "F"   "P"   "E"   "E"   "V"
## Glyma.18G030200.1 "V"   "R"   "K"   "T"   "R"   "V"   "V"   "D"   "V"   "V"
##                   [,22] [,23] [,24] [,25] [,26] [,27] [,28] [,29] [,30] [,31]
## Glyma.16G050500.1 "I"   "E"   "H"   "I"   "F"   "D"   "Y"   "V"   "V"   "S"
## Glyma.16G146400.1 "I"   "G"   "H"   "I"   "F"   "G"   "C"   "V"   "T"   "S"
## Glyma.04G093500.1 "L"   "E"   "S"   "V"   "L"   "H"   "F"   "L"   "T"   "S"
## Glyma.02G065300.1 "I"   "E"   "H"   "I"   "F"   "D"   "Y"   "V"   "T"   "S"
## Glyma.02G211800.1 "L"   "E"   "N"   "V"   "L"   "H"   "F"   "L"   "P"   "S"
## Glyma.02G254300.1 "L"   "D"   "C"   "V"   "M"   "P"   "Y"   "I"   "H"   "D"
## Glyma.02G152800.2 "L"   "E"   "H"   "V"   "F"   "S"   "F"   "I"   "E"   "C"
## Glyma.10G021500.2 "L"   "E"   "H"   "V"   "F"   "S"   "F"   "I"   "E"   "C"
## Glyma.08G059500.6 "L"   "E"   "R"   "I"   "S"   "G"   "M"   "L"   "K"   "S"
## Glyma.07G189800.5 "L"   "E"   "R"   "I"   "L"   "G"   "M"   "L"   "K"   "S"
## Glyma.11G227300.1 "L"   "D"   "C"   "V"   "I"   "P"   "Y"   "I"   "D"   "D"
## Glyma.14G179500.1 "L"   "E"   "N"   "V"   "L"   "H"   "F"   "L"   "S"   "S"
## Glyma.14G062100.1 "L"   "D"   "C"   "V"   "M"   "P"   "Y"   "I"   "H"   "D"
## Glyma.06G095400.1 "L"   "E"   "S"   "V"   "L"   "H"   "F"   "L"   "T"   "S"
## Glyma.03G209400.1 "L"   "E"   "H"   "V"   "F"   "S"   "F"   "I"   "W"   "S"
## Glyma.19G100200.1 "I"   "E"   "H"   "I"   "F"   "D"   "Y"   "V"   "V"   "S"
## Glyma.19G206800.1 "L"   "E"   "H"   "V"   "F"   "S"   "F"   "I"   "W"   "N"
## Glyma.18G030200.1 "L"   "D"   "C"   "V"   "I"   "P"   "Y"   "I"   "D"   "D"
##                   [,32] [,33] [,34] [,35] [,36] [,37] [,38] [,39] [,40] [,41]
## Glyma.16G050500.1 "H"   "S"   "D"   "R"   "N"   "A"   "L"   "S"   "L"   "V"
## Glyma.16G146400.1 "Q"   "R"   "D"   "R"   "N"   "A"   "V"   "S"   "L"   "V"
## Glyma.04G093500.1 "R"   "R"   "D"   "R"   "N"   "A"   "A"   "S"   "L"   "V"
## Glyma.02G065300.1 "Q"   "R"   "D"   "R"   "N"   "D"   "L"   "S"   "L"   "V"
```

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## Glyma.02G211800.1 "R"   "R"   "D"   "R"   "N"   "A"   "A"   "S"   "L"   "V"
## Glyma.02G254300.1 "S"   "K"   "D"   "R"   "D"   "A"   "V"   "S"   "Q"   "V"
## Glyma.02G152800.2 "D"   "K"   "D"   "R"   "G"   "S"   "I"   "S"   "L"   "V"
## Glyma.10G021500.2 "D"   "K"   "D"   "R"   "G"   "S"   "I"   "S"   "L"   "V"
## Glyma.08G059500.6 "R"   "K"   "D"   "K"   "S"   "T"   "V"   "S"   "L"   "V"
## Glyma.07G189800.5 "R"   "K"   "D"   "K"   "S"   "T"   "V"   "S"   "L"   "V"
## Glyma.11G227300.1 "P"   "K"   "D"   "R"   "D"   "A"   "V"   "S"   "Q"   "V"
## Glyma.14G179500.1 "R"   "R"   "D"   "R"   "N"   "A"   "A"   "S"   "L"   "V"
## Glyma.14G062100.1 "S"   "K"   "D"   "R"   "D"   "A"   "V"   "S"   "Q"   "V"
## Glyma.06G095400.1 "R"   "R"   "D"   "R"   "N"   "A"   "A"   "S"   "L"   "V"
## Glyma.03G209400.1 "E"   "R"   "D"   "R"   "N"   "A"   "I"   "S"   "L"   "V"
## Glyma.19G100200.1 "H"   "S"   "D"   "R"   "N"   "A"   "L"   "S"   "L"   "V"
## Glyma.19G206800.1 "E"   "R"   "D"   "R"   "N"   "A"   "I"   "S"   "L"   "V"
## Glyma.18G030200.1 "P"   "K"   "D"   "R"   "D"   "A"   "V"   "S"   "Q"   "V"
##                   [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49] [,50] [,51]
## Glyma.16G050500.1 "C"   "K"   "S"   "W"   "Y"   "R"   "I"   "E"   "R"   "C"
## Glyma.16G146400.1 "C"   "K"   "N"   "W"   "H"   "R"   "L"   "E"   "R"   "C"
## Glyma.04G093500.1 "C"   "K"   "S"   "W"   "Y"   "R"   "A"   "E"   "A"   "L"
## Glyma.02G065300.1 "C"   "K"   "N"   "W"   "H"   "R"   "L"   "E"   "R"   "C"
## Glyma.02G211800.1 "C"   "R"   "S"   "W"   "Y"   "R"   "A"   "E"   "A"   "L"
## Glyma.02G254300.1 "C"   "R"   "R"   "W"   "Y"   "E"   "L"   "D"   "S"   "L"
## Glyma.02G152800.2 "C"   "K"   "S"   "W"   "Y"   "E"   "I"   "E"   "R"   "W"
## Glyma.10G021500.2 "C"   "K"   "S"   "W"   "Y"   "E"   "I"   "E"   "R"   "W"
## Glyma.08G059500.6 "C"   "K"   "E"   "W"   "Y"   "N"   "A"   "E"   "R"   "W"
## Glyma.07G189800.5 "C"   "K"   "E"   "W"   "F"   "N"   "A"   "E"   "R"   "W"
## Glyma.11G227300.1 "C"   "R"   "R"   "W"   "Y"   "E"   "L"   "D"   "S"   "L"
## Glyma.14G179500.1 "C"   "R"   "S"   "W"   "Y"   "R"   "A"   "E"   "A"   "L"
## Glyma.14G062100.1 "C"   "R"   "R"   "L"   "Y"   "E"   "L"   "D"   "S"   "L"
## Glyma.06G095400.1 "C"   "K"   "S"   "W"   "Y"   "R"   "A"   "E"   "A"   "L"
## Glyma.03G209400.1 "C"   "K"   "S"   "W"   "Y"   "E"   "I"   "E"   "R"   "W"
## Glyma.19G100200.1 "C"   "K"   "S"   "W"   "Y"   "R"   "I"   "E"   "R"   "C"
## Glyma.19G206800.1 "C"   "K"   "S"   "W"   "Y"   "E"   "I"   "E"   "R"   "W"
## Glyma.18G030200.1 "C"   "R"   "R"   "W"   "Y"   "E"   "L"   "D"   "S"   "L"
##                   [,52] [,53] [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61]
## Glyma.16G050500.1 "T"   "R"   "Q"   "R"   "V"   "F"   "I"   "G"   "N"   "C"
## Glyma.16G146400.1 "C"   "R"   "K"   "S"   "L"   "F"   "I"   "G"   "N"   "C"
## Glyma.04G093500.1 "T"   "R"   "T"   "E"   "L"   "F"   "I"   "G"   "N"   "C"
## Glyma.02G065300.1 "S"   "R"   "K"   "S"   "L"   "F"   "I"   "G"   "N"   "C"
## Glyma.02G211800.1 "T"   "R"   "S"   "E"   "L"   "F"   "I"   "G"   "N"   "C"
## Glyma.02G254300.1 "T"   "R"   "K"   "H"   "V"   "T"   "I"   "A"   "L"   "C"
## Glyma.02G152800.2 "C"   "R"   "R"   "R"   "V"   "F"   "V"   "G"   "N"   "C"
## Glyma.10G021500.2 "C"   "R"   "R"   "R"   "V"   "F"   "V"   "G"   "N"   "C"
## Glyma.08G059500.6 "S"   "R"   "R"   "S"   "V"   "F"   "I"   "G"   "N"   "C"
## Glyma.07G189800.5 "S"   "R"   "R"   "S"   "V"   "F"   "I"   "G"   "N"   "C"
## Glyma.11G227300.1 "T"   "R"   "K"   "H"   "V"   "T"   "I"   "A"   "L"   "C"
## Glyma.14G179500.1 "T"   "R"   "S"   "E"   "L"   "F"   "I"   "G"   "N"   "C"
## Glyma.14G062100.1 "T"   "R"   "K"   "H"   "V"   "T"   "I"   "A"   "L"   "C"
## Glyma.06G095400.1 "T"   "R"   "P"   "D"   "L"   "F"   "I"   "G"   "N"   "C"
## Glyma.03G209400.1 "C"   "R"   "R"   "K"   "V"   "F"   "V"   "G"   "N"   "C"
## Glyma.19G100200.1 "T"   "R"   "Q"   "R"   "V"   "F"   "I"   "G"   "N"   "C"
## Glyma.19G206800.1 "C"   "R"   "R"   "K"   "V"   "F"   "V"   "G"   "N"   "C"
## Glyma.18G030200.1 "T"   "R"   "K"   "H"   "V"   "T"   "I"   "A"   "L"   "C"
##                   [,62] [,63] [,64] [,65] [,66] [,67] [,68] [,69] [,70] [,71]
## Glyma.16G050500.1 "Y"   "S"   "I"   "T"   "P"   "E"   "R"   "L"   "I"   "Q"
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## Glyma.16G146400.1 "Y"   "T"   "I"   "S"   "P"   "E"   "R"   "V"   "I"   "E"
## Glyma.04G093500.1 "Y"   "A"   "V"   "S"   "P"   "R"   "R"   "A"   "T"   "G"
## Glyma.02G065300.1 "Y"   "S"   "I"   "S"   "P"   "E"   "R"   "V"   "I"   "E"
## Glyma.02G211800.1 "Y"   "A"   "L"   "S"   "P"   "T"   "R"   "A"   "T"   "A"
## Glyma.02G254300.1 "Y"   "T"   "T"   "T"   "P"   "D"   "R"   "L"   "R"   "R"
## Glyma.02G152800.2 "Y"   "A"   "V"   "S"   "P"   "A"   "T"   "V"   "V"   "N"
## Glyma.10G021500.2 "Y"   "A"   "V"   "S"   "P"   "A"   "T"   "V"   "V"   "N"
## Glyma.08G059500.6 "Y"   "S"   "V"   "S"   "P"   "E"   "I"   "L"   "T"   "R"
## Glyma.07G189800.5 "Y"   "S"   "V"   "S"   "P"   "E"   "I"   "L"   "T"   "R"
## Glyma.11G227300.1 "Y"   "T"   "T"   "T"   "P"   "A"   "R"   "L"   "R"   "R"
## Glyma.14G179500.1 "Y"   "A"   "L"   "S"   "P"   "T"   "R"   "A"   "T"   "A"
## Glyma.14G062100.1 "Y"   "T"   "T"   "T"   "P"   "D"   "R"   "L"   "R"   "R"
## Glyma.06G095400.1 "Y"   "A"   "V"   "S"   "P"   "R"   "R"   "A"   "T"   "A"
## Glyma.03G209400.1 "Y"   "A"   "V"   "S"   "P"   "L"   "M"   "V"   "I"   "K"
## Glyma.19G100200.1 "Y"   "S"   "I"   "T"   "P"   "E"   "R"   "L"   "I"   "Q"
## Glyma.19G206800.1 "Y"   "A"   "V"   "S"   "P"   "L"   "M"   "V"   "V"   "K"
## Glyma.18G030200.1 "Y"   "T"   "T"   "T"   "P"   "A"   "R"   "L"   "R"   "R"
##                   [,72] [,73] [,74] [,75] [,76] [,77] [,78] [,79] [,80] [,81]
## Glyma.16G050500.1 "R"   "F"   "P"   "G"   "L"   "K"   "S"   "L"   "T"   "L"
## Glyma.16G146400.1 "R"   "F"   "P"   "E"   "L"   "R"   "S"   "L"   "T"   "L"
## Glyma.04G093500.1 "R"   "F"   "P"   "R"   "V"   "R"   "S"   "V"   "T"   "I"
## Glyma.02G065300.1 "R"   "F"   "P"   "E"   "L"   "K"   "S"   "L"   "T"   "L"
## Glyma.02G211800.1 "R"   "F"   "T"   "R"   "V"   "M"   "S"   "V"   "T"   "V"
## Glyma.02G254300.1 "R"   "F"   "P"   "H"   "L"   "E"   "S"   "L"   "K"   "L"
## Glyma.02G152800.2 "R"   "F"   "P"   "K"   "V"   "R"   "S"   "I"   "A"   "I"
## Glyma.10G021500.2 "R"   "F"   "P"   "K"   "V"   "R"   "S"   "I"   "A"   "I"
## Glyma.08G059500.6 "R"   "F"   "P"   "N"   "I"   "R"   "S"   "V"   "T"   "L"
## Glyma.07G189800.5 "R"   "F"   "P"   "N"   "I"   "R"   "S"   "V"   "T"   "L"
## Glyma.11G227300.1 "R"   "F"   "P"   "H"   "L"   "E"   "S"   "L"   "K"   "L"
## Glyma.14G179500.1 "R"   "F"   "T"   "R"   "A"   "R"   "S"   "V"   "T"   "V"
## Glyma.14G062100.1 "R"   "F"   "P"   "H"   "L"   "E"   "S"   "L"   "N"   "L"
## Glyma.06G095400.1 "R"   "F"   "P"   "R"   "V"   "R"   "S"   "L"   "T"   "I"
## Glyma.03G209400.1 "R"   "F"   "P"   "E"   "L"   "R"   "S"   "I"   "A"   "L"
## Glyma.19G100200.1 "R"   "F"   "P"   "G"   "L"   "K"   "S"   "L"   "T"   "L"
## Glyma.19G206800.1 "R"   "F"   "P"   "E"   "V"   "R"   "S"   "I"   "A"   "L"
## Glyma.18G030200.1 "R"   "F"   "P"   "H"   "L"   "E"   "S"   "L"   "K"   "L"
##                   [,82] [,83] [,84] [,85] [,86] [,87] [,88] [,89] [,90] [,91]
## Glyma.16G050500.1 "K"   "G"   "K"   "P"   "H"   "F"   "A"   "D"   "F"   "S"
## Glyma.16G146400.1 "K"   "G"   "K"   "P"   "H"   "F"   "P"   "Y"   "F"   "S"
## Glyma.04G093500.1 "K"   "G"   "K"   "P"   "R"   "F"   "A"   "D"   "F"   "D"
## Glyma.02G065300.1 "K"   "G"   "K"   "P"   "H"   "F"   "A"   "D"   "F"   "N"
## Glyma.02G211800.1 "K"   "G"   "K"   "P"   "R"   "F"   "A"   "D"   "F"   "D"
## Glyma.02G254300.1 "K"   "G"   "K"   "P"   "R"   "A"   "A"   "M"   "F"   "N"
## Glyma.02G152800.2 "K"   "G"   "K"   "P"   "H"   "F"   "A"   "D"   "F"   "N"
## Glyma.10G021500.2 "K"   "G"   "K"   "P"   "H"   "F"   "A"   "D"   "F"   "N"
## Glyma.08G059500.6 "K"   "G"   "K"   "P"   "R"   "F"   "S"   "D"   "F"   "N"
## Glyma.07G189800.5 "K"   "G"   "K"   "P"   "R"   "F"   "S"   "D"   "F"   "N"
## Glyma.11G227300.1 "K"   "G"   "K"   "P"   "R"   "A"   "A"   "M"   "F"   "N"
## Glyma.14G179500.1 "K"   "G"   "K"   "P"   "R"   "F"   "A"   "D"   "F"   "D"
## Glyma.14G062100.1 "K"   "G"   "K"   "P"   "R"   "A"   "A"   "M"   "F"   "N"
## Glyma.06G095400.1 "K"   "G"   "K"   "P"   "R"   "F"   "A"   "D"   "F"   "D"
## Glyma.03G209400.1 "K"   "G"   "K"   "P"   "H"   "F"   "A"   "D"   "F"   "N"
## Glyma.19G100200.1 "K"   "G"   "K"   "P"   "H"   "F"   "A"   "D"   "F"   "S"
## Glyma.19G206800.1 "K"   "G"   "K"   "P"   "H"   "F"   "A"   "D"   "F"   "N"
```

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## Glyma.18G030200.1 "K"   "G"   "K"   "P"   "R"   "A"   "A"   "M"   "F"   "N"
##                   [,92] [,93] [,94] [,95] [,96] [,97] [,98] [,99] [,100] [,101]
## Glyma.16G050500.1 "L"   "V"   "P"   "Y"   "D"   "W"   "G"   "G"   "F"    "V"
## Glyma.16G146400.1 "L"   "V"   "P"   "S"   "G"   "W"   "G"   "G"   "F"    "V"
## Glyma.04G093500.1 "L"   "M"   "P"   "L"   "N"   "W"   "G"   "A"   "H"    "F"
## Glyma.02G065300.1 "L"   "V"   "P"   "H"   "G"   "W"   "G"   "G"   "F"    "V"
## Glyma.02G211800.1 "L"   "M"   "P"   "P"   "D"   "W"   "G"   "A"   "H"    "F"
## Glyma.02G254300.1 "L"   "I"   "P"   "E"   "D"   "W"   "G"   "G"   "F"    "V"
## Glyma.02G152800.2 "L"   "V"   "P"   "E"   "G"   "W"   "G"   "A"   "Y"    "V"
## Glyma.10G021500.2 "L"   "V"   "P"   "E"   "G"   "W"   "G"   "A"   "Y"    "V"
## Glyma.08G059500.6 "L"   "V"   "P"   "A"   "N"   "W"   "G"   "A"   "D"    "I"
## Glyma.07G189800.5 "L"   "V"   "P"   "A"   "N"   "W"   "G"   "A"   "D"    "I"
## Glyma.11G227300.1 "L"   "I"   "P"   "E"   "D"   "W"   "G"   "G"   "H"    "V"
## Glyma.14G179500.1 "L"   "M"   "P"   "A"   "D"   "W"   "G"   "A"   "H"    "F"
## Glyma.14G062100.1 "L"   "I"   "P"   "E"   "D"   "W"   "G"   "G"   "F"    "V"
## Glyma.06G095400.1 "L"   "M"   "P"   "L"   "N"   "W"   "G"   "A"   "H"    "F"
## Glyma.03G209400.1 "L"   "V"   "P"   "E"   "G"   "W"   "G"   "G"   "Y"    "V"
## Glyma.19G100200.1 "L"   "V"   "P"   "Y"   "D"   "W"   "G"   "G"   "F"    "V"
## Glyma.19G206800.1 "L"   "V"   "P"   "D"   "G"   "W"   "G"   "G"   "Y"    "V"
## Glyma.18G030200.1 "L"   "I"   "P"   "E"   "D"   "W"   "G"   "G"   "H"    "V"
##                   [,102] [,103] [,104] [,105] [,106] [,107] [,108] [,109]
## Glyma.16G050500.1 "H"    "P"    "W"    "I"    "E"    "A"    "L"    "A"
## Glyma.16G146400.1 "A"    "P"    "W"    "I"    "E"    "A"    "L"    "A"
## Glyma.04G093500.1 "T"    "P"    "W"    "V"    "T"    "A"    "L"    "S"
## Glyma.02G065300.1 "S"    "P"    "W"    "I"    "E"    "A"    "M"    "V"
## Glyma.02G211800.1 "G"    "P"    "W"    "A"    "S"    "A"    "L"    "A"
## Glyma.02G254300.1 "T"    "P"    "W"    "V"    "R"    "V"    "I"    "S"
## Glyma.02G152800.2 "G"    "P"    "W"    "I"    "K"    "A"    "M"    "A"
## Glyma.10G021500.2 "G"    "P"    "W"    "I"    "K"    "A"    "M"    "A"
## Glyma.08G059500.6 "H"    "S"    "W"    "L"    "V"    "V"    "F"    "A"
## Glyma.07G189800.5 "H"    "S"    "W"    "L"    "V"    "V"    "F"    "A"
## Glyma.11G227300.1 "T"    "P"    "W"    "V"    "K"    "E"    "I"    "S"
## Glyma.14G179500.1 "S"    "P"    "W"    "A"    "S"    "A"    "L"    "S"
## Glyma.14G062100.1 "T"    "P"    "W"    "V"    "R"    "E"    "I"    "S"
## Glyma.06G095400.1 "T"    "P"    "W"    "A"    "T"    "A"    "L"    "S"
## Glyma.03G209400.1 "C"    "P"    "W"    "I"    "A"    "A"    "M"    "A"
## Glyma.19G100200.1 "H"    "P"    "W"    "V"    "E"    "A"    "L"    "A"
## Glyma.19G206800.1 "C"    "P"    "W"    "I"    "A"    "A"    "M"    "A"
## Glyma.18G030200.1 "T"    "P"    "W"    "V"    "K"    "E"    "I"    "S"
##                   [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117]
## Glyma.16G050500.1 "K"    "N"    "K"    "V"    "G"    "L"    "E"    "E"
## Glyma.16G146400.1 "R"    "S"    "R"    "V"    "D"    "L"    "E"    "E"
## Glyma.04G093500.1 "Q"    "S"    "Y"    "H"    "S"    "L"    "N"    "K"
## Glyma.02G065300.1 "K"    "S"    "R"    "V"    "D"    "L"    "E"    "E"
## Glyma.02G211800.1 "Q"    "A"    "Y"    "P"    "W"    "L"    "E"    "K"
## Glyma.02G254300.1 "Q"    "Y"    "F"    "D"    "C"    "L"    "K"    "S"
## Glyma.02G152800.2 "A"    "A"    "Y"    "P"    "W"    "L"    "Q"    "E"
## Glyma.10G021500.2 "A"    "A"    "Y"    "P"    "W"    "L"    "Q"    "E"
## Glyma.08G059500.6 "G"    "K"    "Y"    "P"    "W"    "L"    "E"    "E"
## Glyma.07G189800.5 "E"    "K"    "Y"    "P"    "W"    "L"    "E"    "E"
## Glyma.11G227300.1 "Q"    "Y"    "F"    "D"    "C"    "L"    "K"    "S"
## Glyma.14G179500.1 "Q"    "A"    "Y"    "P"    "W"    "L"    "E"    "K"
## Glyma.14G062100.1 "Q"    "Y"    "F"    "D"    "C"    "L"    "K"    "S"
## Glyma.06G095400.1 "Q"    "S"    "Y"    "P"    "S"    "L"    "N"    "K"
```

```
## Glyma.03G209400.1 "R"    "A"    "F"    "P"    "C"    "L"    "E"    "E"
## Glyma.19G100200.1 "K"    "S"    "R"    "V"    "G"    "L"    "E"    "E"
## Glyma.19G206800.1 "R"    "A"    "F"    "P"    "C"    "L"    "E"    "E"
## Glyma.18G030200.1 "Q"    "Y"    "F"    "D"    "C"    "L"    "K"    "S"
##                   [,118] [,119] [,120] [,121] [,122] [,123] [,124] [,125]
## Glyma.16G050500.1 "L"    "R"    "L"    "K"    "R"    "M"    "V"    "V"
## Glyma.16G146400.1 "L"    "R"    "L"    "K"    "R"    "M"    "V"    "V"
## Glyma.04G093500.1 "L"    "H"    "L"    "K"    "R"    "M"    "S"    "L"
## Glyma.02G065300.1 "L"    "R"    "L"    "K"    "R"    "M"    "V"    "V"
## Glyma.02G211800.1 "L"    "H"    "L"    "K"    "R"    "M"    "L"    "V"
## Glyma.02G254300.1 "L"    "H"    "F"    "R"    "R"    "M"    "I"    "V"
## Glyma.02G152800.2 "I"    "R"    "L"    "K"    "R"    "M"    "V"    "I"
## Glyma.10G021500.2 "I"    "R"    "L"    "K"    "R"    "M"    "V"    "I"
## Glyma.08G059500.6 "L"    "R"    "L"    "K"    "R"    "M"    "T"    "V"
## Glyma.07G189800.5 "L"    "R"    "L"    "K"    "R"    "M"    "T"    "V"
## Glyma.11G227300.1 "L"    "H"    "F"    "R"    "R"    "M"    "I"    "V"
## Glyma.14G179500.1 "L"    "H"    "L"    "K"    "R"    "M"    "L"    "L"
## Glyma.14G062100.1 "L"    "H"    "F"    "R"    "R"    "M"    "I"    "V"
## Glyma.06G095400.1 "L"    "H"    "L"    "K"    "R"    "M"    "S"    "L"
## Glyma.03G209400.1 "I"    "R"    "L"    "K"    "R"    "M"    "V"    "I"
## Glyma.19G100200.1 "L"    "R"    "L"    "K"    "R"    "M"    "V"    "V"
## Glyma.19G206800.1 "I"    "R"    "L"    "K"    "R"    "M"    "V"    "I"
## Glyma.18G030200.1 "L"    "H"    "F"    "R"    "R"    "M"    "I"    "V"
##                   [,126] [,127] [,128] [,129] [,130] [,131] [,132] [,133]
## Glyma.16G050500.1 "S"    "D"    "E"    "S"    "L"    "E"    "L"    "L"
## Glyma.16G146400.1 "S"    "D"    "E"    "S"    "L"    "E"    "L"    "L"
## Glyma.04G093500.1 "T"    "D"    "H"    "D"    "L"    "T"    "L"    "L"
## Glyma.02G065300.1 "T"    "D"    "K"    "S"    "L"    "E"    "L"    "L"
## Glyma.02G211800.1 "T"    "D"    "A"    "D"    "L"    "A"    "L"    "I"
## Glyma.02G254300.1 "R"    "D"    "S"    "D"    "L"    "Q"    "V"    "L"
## Glyma.02G152800.2 "A"    "D"    "E"    "C"    "L"    "E"    "L"    "I"
## Glyma.10G021500.2 "S"    "D"    "E"    "C"    "L"    "E"    "L"    "I"
## Glyma.08G059500.6 "T"    "D"    "E"    "S"    "L"    "E"    "F"    "L"
## Glyma.07G189800.5 "T"    "D"    "E"    "S"    "L"    "E"    "F"    "L"
## Glyma.11G227300.1 "K"    "D"    "S"    "D"    "L"    "R"    "N"    "L"
## Glyma.14G179500.1 "T"    "D"    "A"    "D"    "L"    "A"    "L"    "I"
## Glyma.14G062100.1 "R"    "D"    "S"    "D"    "L"    "Q"    "V"    "L"
## Glyma.06G095400.1 "T"    "D"    "H"    "D"    "L"    "I"    "L"    "L"
## Glyma.03G209400.1 "T"    "D"    "E"    "S"    "L"    "E"    "L"    "I"
## Glyma.19G100200.1 "S"    "D"    "E"    "S"    "L"    "E"    "L"    "L"
## Glyma.19G206800.1 "T"    "D"    "E"    "S"    "L"    "E"    "L"    "I"
## Glyma.18G030200.1 "K"    "D"    "S"    "D"    "L"    "Q"    "N"    "L"
##                   [,134] [,135] [,136] [,137] [,138] [,139] [,140] [,141]
## Glyma.16G050500.1 "S"    "R"    "S"    "F"    "T"    "H"    "F"    "K"
## Glyma.16G146400.1 "S"    "R"    "S"    "F"    "V"    "N"    "F"    "K"
## Glyma.04G093500.1 "S"    "H"    "S"    "L"    "P"    "S"    "F"    "Q"
## Glyma.02G065300.1 "S"    "R"    "S"    "F"    "M"    "N"    "F"    "K"
## Glyma.02G211800.1 "A"    "D"    "S"    "F"    "A"    "G"    "F"    "R"
## Glyma.02G254300.1 "A"    "R"    "S"    "R"    "G"    "H"    "L"    "Q"
## Glyma.02G152800.2 "A"    "K"    "S"    "F"    "K"    "N"    "F"    "Q"
## Glyma.10G021500.2 "A"    "K"    "S"    "F"    "K"    "N"    "F"    "Q"
## Glyma.08G059500.6 "A"    "L"    "Q"    "F"    "P"    "N"    "F"    "K"
## Glyma.07G189800.5 "A"    "L"    "K"    "F"    "P"    "N"    "F"    "K"
## Glyma.11G227300.1 "A"    "R"    "D"    "R"    "G"    "H"    "L"    "H"
```

```
## Glyma.14G179500.1 "A"    "D"    "S"    "F"    "A"    "A"    "F"    "R"
## Glyma.14G062100.1 "A"    "R"    "S"    "R"    "G"    "H"    "L"    "Q"
## Glyma.06G095400.1 "S"    "H"    "S"    "F"    "P"    "S"    "F"    "Q"
## Glyma.03G209400.1 "A"    "K"    "S"    "F"    "K"    "N"    "F"    "K"
## Glyma.19G100200.1 "S"    "R"    "S"    "F"    "T"    "H"    "F"    "K"
## Glyma.19G206800.1 "A"    "K"    "S"    "F"    "K"    "N"    "F"    "K"
## Glyma.18G030200.1 "A"    "R"    "D"    "R"    "G"    "H"    "L"    "H"
##                   [,142] [,143] [,144] [,145] [,146] [,147] [,148] [,149]
## Glyma.16G050500.1 "S"    "L"    "V"    "L"    "V"    "S"    "C"    "E"
## Glyma.16G146400.1 "S"    "L"    "V"    "L"    "V"    "R"    "C"    "E"
## Glyma.04G093500.1 "D"    "L"    "L"    "L"    "T"    "C"    "C"    "E"
## Glyma.02G065300.1 "S"    "L"    "V"    "L"    "V"    "S"    "C"    "E"
## Glyma.02G211800.1 "E"    "L"    "V"    "L"    "V"    "C"    "C"    "E"
## Glyma.02G254300.1 "A"    "L"    "R"    "L"    "E"    "N"    "C"    "S"
## Glyma.02G152800.2 "V"    "L"    "V"    "L"    "T"    "S"    "C"    "E"
## Glyma.10G021500.2 "V"    "L"    "V"    "L"    "T"    "S"    "C"    "E"
## Glyma.08G059500.6 "A"    "L"    "S"    "L"    "L"    "S"    "C"    "D"
## Glyma.07G189800.5 "A"    "L"    "S"    "L"    "L"    "S"    "C"    "D"
## Glyma.11G227300.1 "S"    "L"    "K"    "L"    "D"    "K"    "C"    "S"
## Glyma.14G179500.1 "E"    "L"    "V"    "L"    "V"    "C"    "C"    "E"
## Glyma.14G062100.1 "A"    "L"    "K"    "L"    "D"    "K"    "C"    "S"
## Glyma.06G095400.1 "D"    "L"    "V"    "L"    "T"    "C"    "C"    "E"
## Glyma.03G209400.1 "V"    "L"    "V"    "L"    "T"    "S"    "C"    "E"
## Glyma.19G100200.1 "S"    "L"    "V"    "L"    "V"    "S"    "C"    "E"
## Glyma.19G206800.1 "V"    "L"    "V"    "L"    "T"    "S"    "C"    "E"
## Glyma.18G030200.1 "A"    "L"    "K"    "L"    "D"    "K"    "C"    "S"
##                   [,150] [,151] [,152] [,153] [,154] [,155] [,156] [,157]
## Glyma.16G050500.1 "G"    "F"    "S"    "T"    "D"    "G"    "L"    "A"
## Glyma.16G146400.1 "G"    "F"    "T"    "T"    "E"    "G"    "L"    "A"
## Glyma.04G093500.1 "G"    "F"    "G"    "T"    "T"    "A"    "L"    "A"
## Glyma.02G065300.1 "G"    "F"    "T"    "T"    "D"    "G"    "L"    "A"
## Glyma.02G211800.1 "G"    "F"    "G"    "T"    "P"    "G"    "L"    "A"
## Glyma.02G254300.1 "G"    "F"    "S"    "T"    "D"    "G"    "L"    "Y"
## Glyma.02G152800.2 "G"    "F"    "T"    "T"    "D"    "G"    "L"    "A"
## Glyma.10G021500.2 "G"    "F"    "T"    "T"    "D"    "G"    "L"    "A"
## Glyma.08G059500.6 "G"    "F"    "S"    "T"    "D"    "G"    "L"    "A"
## Glyma.07G189800.5 "G"    "F"    "S"    "T"    "D"    "G"    "L"    "A"
## Glyma.11G227300.1 "G"    "F"    "T"    "T"    "D"    "G"    "L"    "F"
## Glyma.14G179500.1 "G"    "F"    "G"    "T"    "P"    "G"    "L"    "A"
## Glyma.14G062100.1 "G"    "F"    "S"    "T"    "D"    "G"    "L"    "Y"
## Glyma.06G095400.1 "G"    "F"    "G"    "T"    "T"    "G"    "L"    "A"
## Glyma.03G209400.1 "G"    "F"    "T"    "A"    "D"    "G"    "L"    "T"
## Glyma.19G100200.1 "G"    "F"    "S"    "T"    "D"    "G"    "L"    "A"
## Glyma.19G206800.1 "G"    "F"    "T"    "T"    "D"    "G"    "L"    "A"
## Glyma.18G030200.1 "G"    "F"    "T"    "T"    "D"    "G"    "L"    "F"
##                   [,158] [,159] [,160] [,161] [,162] [,163] [,164] [,165]
## Glyma.16G050500.1 "A"    "L"    "A"    "A"    "N"    "C"    "R"    "F"
## Glyma.16G146400.1 "A"    "I"    "A"    "A"    "N"    "C"    "R"    "F"
## Glyma.04G093500.1 "A"    "L"    "A"    "S"    "N"    "C"    "R"    "L"
## Glyma.02G065300.1 "A"    "I"    "A"    "A"    "N"    "C"    "R"    "F"
## Glyma.02G211800.1 "A"    "V"    "A"    "S"    "K"    "C"    "R"    "L"
## Glyma.02G254300.1 "Y"    "I"    "G"    "R"    "Y"    "C"    "R"    "N"
## Glyma.02G152800.2 "A"    "I"    "A"    "A"    "N"    "C"    "R"    "N"
## Glyma.10G021500.2 "A"    "I"    "A"    "A"    "N"    "C"    "R"    "N"
```

```
## Glyma.08G059500.6 "S"    "I"    "A"    "T"    "N"    "C"    "K"    "N"
## Glyma.07G189800.5 "S"    "I"    "A"    "T"    "N"    "C"    "K"    "N"
## Glyma.11G227300.1 "H"    "I"    "G"    "R"    "F"    "C"    "K"    "S"
## Glyma.14G179500.1 "V"    "V"    "V"    "S"    "K"    "C"    "R"    "L"
## Glyma.14G062100.1 "Y"    "I"    "G"    "R"    "Y"    "C"    "R"    "N"
## Glyma.06G095400.1 "A"    "L"    "T"    "S"    "N"    "C"    "R"    "L"
## Glyma.03G209400.1 "A"    "I"    "A"    "S"    "N"    "C"    "R"    "N"
## Glyma.19G100200.1 "A"    "I"    "A"    "A"    "N"    "C"    "R"    "F"
## Glyma.19G206800.1 "A"    "I"    "A"    "A"    "N"    "C"    "R"    "N"
## Glyma.18G030200.1 "H"    "I"    "G"    "R"    "F"    "C"    "K"    "S"
##                   [,166] [,167] [,168] [,169] [,170] [,171] [,172] [,173]
## Glyma.16G050500.1 "L"    "R"    "E"    "L"    "D"    "L"    "Q"    "E"
## Glyma.16G146400.1 "L"    "K"    "D"    "L"    "D"    "L"    "H"    "E"
## Glyma.04G093500.1 "L"    "R"    "V"    "L"    "E"    "L"    "V"    "E"
## Glyma.02G065300.1 "L"    "K"    "E"    "L"    "D"    "L"    "Q"    "E"
## Glyma.02G211800.1 "L"    "R"    "V"    "L"    "E"    "L"    "V"    "E"
## Glyma.02G254300.1 "L"    "R"    "V"    "L"    "F"    "L"    "E"    "E"
## Glyma.02G152800.2 "L"    "R"    "E"    "L"    "E"    "L"    "R"    "E"
## Glyma.10G021500.2 "L"    "R"    "E"    "L"    "E"    "L"    "R"    "E"
## Glyma.08G059500.6 "L"    "T"    "E"    "L"    "D"    "I"    "Q"    "E"
## Glyma.07G189800.5 "L"    "T"    "E"    "L"    "D"    "I"    "Q"    "E"
## Glyma.11G227300.1 "L"    "R"    "V"    "L"    "F"    "L"    "E"    "E"
## Glyma.14G179500.1 "L"    "R"    "V"    "L"    "E"    "L"    "V"    "E"
## Glyma.14G062100.1 "L"    "R"    "V"    "L"    "F"    "L"    "E"    "E"
## Glyma.06G095400.1 "L"    "R"    "V"    "L"    "E"    "L"    "V"    "E"
## Glyma.03G209400.1 "L"    "R"    "E"    "L"    "D"    "L"    "Q"    "E"
## Glyma.19G100200.1 "L"    "R"    "E"    "L"    "D"    "L"    "Q"    "E"
## Glyma.19G206800.1 "L"    "R"    "E"    "L"    "D"    "L"    "Q"    "E"
## Glyma.18G030200.1 "L"    "R"    "V"    "L"    "F"    "L"    "E"    "E"
##                   [,174] [,175] [,176] [,177] [,178] [,179] [,180] [,181]
## Glyma.16G050500.1 "N"    "E"    "V"    "E"    "D"    "H"    "K"    "G"
## Glyma.16G146400.1 "N"    "V"    "V"    "T"    "D"    "L"    "K"    "G"
## Glyma.04G093500.1 "C"    "V"    "V"    "G"    "D"    "E"    "E"    "L"
## Glyma.02G065300.1 "N"    "E"    "V"    "D"    "D"    "H"    "R"    "G"
## Glyma.02G211800.1 "S"    "V"    "V"    "D"    "D"    "E"    "E"    "V"
## Glyma.02G254300.1 "S"    "S"    "L"    "V"    "E"    "K"    "D"    "G"
## Glyma.02G152800.2 "S"    "E"    "V"    "D"    "D"    "I"    "C"    "G"
## Glyma.10G021500.2 "S"    "E"    "V"    "D"    "D"    "I"    "C"    "G"
## Glyma.08G059500.6 "N"    "G"    "I"    "E"    "D"    "K"    "S"    "G"
## Glyma.07G189800.5 "N"    "G"    "I"    "E"    "D"    "K"    "S"    "G"
## Glyma.11G227300.1 "S"    "S"    "I"    "V"    "E"    "K"    "D"    "G"
## Glyma.14G179500.1 "S"    "E"    "V"    "D"    "D"    "E"    "E"    "V"
## Glyma.14G062100.1 "S"    "S"    "L"    "V"    "E"    "N"    "D"    "G"
## Glyma.06G095400.1 "C"    "V"    "V"    "G"    "D"    "E"    "E"    "M"
## Glyma.03G209400.1 "S"    "E"    "V"    "E"    "D"    "L"    "S"    "G"
## Glyma.19G100200.1 "N"    "E"    "V"    "E"    "D"    "H"    "K"    "G"
## Glyma.19G206800.1 "S"    "E"    "V"    "E"    "D"    "L"    "S"    "G"
## Glyma.18G030200.1 "S"    "S"    "I"    "L"    "E"    "K"    "D"    "G"
##                   [,182] [,183] [,184] [,185] [,186] [,187] [,188] [,189]
## Glyma.16G050500.1 "Q"    "W"    "L"    "S"    "C"    "F"    "P"    "D"
## Glyma.16G146400.1 "Q"    "W"    "L"    "S"    "C"    "F"    "P"    "D"
## Glyma.04G093500.1 "D"    "W"    "I"    "S"    "C"    "F"    "P"    "E"
## Glyma.02G065300.1 "Q"    "W"    "L"    "S"    "C"    "F"    "P"    "D"
## Glyma.02G211800.1 "D"    "W"    "I"    "S"    "C"    "F"    "P"    "E"
```

```
## Glyma.02G254300.1 "D"    "W"    "L"    "H"    "E"    "L"    "A"    "L"
## Glyma.02G152800.2 "H"    "W"    "L"    "S"    "H"    "F"    "P"    "D"
## Glyma.10G021500.2 "H"    "W"    "L"    "S"    "H"    "F"    "P"    "D"
## Glyma.08G059500.6 "N"    "W"    "L"    "G"    "C"    "F"    "P"    "D"
## Glyma.07G189800.5 "N"    "W"    "L"    "S"    "C"    "F"    "P"    "D"
## Glyma.11G227300.1 "E"    "W"    "L"    "H"    "E"    "L"    "A"    "L"
## Glyma.14G179500.1 "D"    "W"    "I"    "S"    "C"    "F"    "P"    "E"
## Glyma.14G062100.1 "D"    "W"    "L"    "H"    "E"    "L"    "A"    "L"
## Glyma.06G095400.1 "D"    "W"    "I"    "S"    "C"    "F"    "P"    "E"
## Glyma.03G209400.1 "H"    "W"    "L"    "S"    "H"    "F"    "P"    "D"
## Glyma.19G100200.1 "Q"    "W"    "L"    "S"    "C"    "F"    "P"    "D"
## Glyma.19G206800.1 "H"    "W"    "L"    "S"    "H"    "F"    "P"    "D"
## Glyma.18G030200.1 "E"    "W"    "L"    "H"    "E"    "L"    "A"    "L"
##                   [,190] [,191] [,192] [,193] [,194] [,195] [,196] [,197]
## Glyma.16G050500.1 "N"    "C"    "T"    "S"    "L"    "V"    "S"    "L"
## Glyma.16G146400.1 "C"    "C"    "T"    "S"    "L"    "V"    "S"    "L"
## Glyma.04G093500.1 "I"    "Q"    "T"    "Y"    "L"    "E"    "S"    "L"
## Glyma.02G065300.1 "C"    "C"    "T"    "S"    "L"    "V"    "S"    "L"
## Glyma.02G211800.1 "T"    "Q"    "T"    "N"    "M"    "E"    "S"    "L"
## Glyma.02G254300.1 "N"    "N"    "T"    "V"    "L"    "E"    "T"    "L"
## Glyma.02G152800.2 "S"    "Y"    "T"    "S"    "L"    "V"    "S"    "L"
## Glyma.10G021500.2 "S"    "Y"    "T"    "S"    "L"    "V"    "S"    "L"
## Glyma.08G059500.6 "S"    "F"    "T"    "S"    "L"    "E"    "V"    "L"
## Glyma.07G189800.5 "S"    "F"    "T"    "S"    "L"    "E"    "V"    "L"
## Glyma.11G227300.1 "N"    "N"    "T"    "V"    "L"    "E"    "T"    "L"
## Glyma.14G179500.1 "S"    "Q"    "T"    "N"    "L"    "E"    "S"    "L"
## Glyma.14G062100.1 "N"    "N"    "T"    "V"    "L"    "E"    "T"    "L"
## Glyma.06G095400.1 "S"    "Q"    "T"    "H"    "L"    "E"    "S"    "L"
## Glyma.03G209400.1 "S"    "Y"    "T"    "S"    "L"    "V"    "S"    "L"
## Glyma.19G100200.1 "N"    "C"    "T"    "S"    "L"    "V"    "S"    "L"
## Glyma.19G206800.1 "S"    "Y"    "T"    "S"    "L"    "V"    "S"    "L"
## Glyma.18G030200.1 "N"    "N"    "T"    "V"    "L"    "E"    "T"    "L"
##                   [,198] [,199] [,200] [,201] [,202] [,203] [,204] [,205]
## Glyma.16G050500.1 "N"    "F"    "A"    "C"    "L"    "K"    "G"    "E"
## Glyma.16G146400.1 "N"    "F"    "A"    "C"    "L"    "K"    "G"    "Q"
## Glyma.04G093500.1 "V"    "F"    "D"    "C"    "V"    "E"    "C"    "P"
## Glyma.02G065300.1 "N"    "F"    "A"    "C"    "L"    "K"    "G"    "Q"
## Glyma.02G211800.1 "V"    "F"    "D"    "C"    "V"    "E"    "V"    "P"
## Glyma.02G254300.1 "N"    "F"    "Y"    "V"    "T"    "D"    "A"    "N"
## Glyma.02G152800.2 "N"    "I"    "S"    "C"    "L"    "G"    "N"    "E"
## Glyma.10G021500.2 "N"    "I"    "S"    "C"    "L"    "G"    "N"    "E"
## Glyma.08G059500.6 "N"    "F"    "A"    "N"    "L"    "H"    "N"    "D"
## Glyma.07G189800.5 "N"    "F"    "A"    "N"    "L"    "H"    "N"    "D"
## Glyma.11G227300.1 "N"    "F"    "Y"    "L"    "T"    "D"    "A"    "V"
## Glyma.14G179500.1 "V"    "F"    "D"    "C"    "V"    "D"    "V"    "P"
## Glyma.14G062100.1 "N"    "F"    "Y"    "L"    "T"    "D"    "A"    "N"
## Glyma.06G095400.1 "V"    "F"    "D"    "C"    "V"    "E"    "C"    "P"
## Glyma.03G209400.1 "N"    "I"    "S"    "C"    "L"    "N"    "H"    "E"
## Glyma.19G100200.1 "N"    "F"    "A"    "C"    "L"    "K"    "G"    "E"
## Glyma.19G206800.1 "N"    "I"    "S"    "C"    "L"    "N"    "N"    "E"
## Glyma.18G030200.1 "N"    "F"    "Y"    "L"    "T"    "D"    "A"    "V"
##                   [,206] [,207] [,208] [,209] [,210] [,211] [,212] [,213]
## Glyma.16G050500.1 "V"    "S"    "L"    "G"    "A"    "L"    "E"    "R"
## Glyma.16G146400.1 "I"    "N"    "A"    "G"    "D"    "L"    "E"    "R"
```

```
## Glyma.04G093500.1 "I"    "N"    "L"    "E"    "A"    "L"    "E"    "R"
## Glyma.02G065300.1 "I"    "N"    "L"    "G"    "A"    "L"    "E"    "R"
## Glyma.02G211800.1 "I"    "N"    "F"    "E"    "A"    "L"    "E"    "G"
## Glyma.02G254300.1 "V"    "R"    "I"    "Q"    "D"    "L"    "E"    "L"
## Glyma.02G152800.2 "V"    "N"    "L"    "S"    "A"    "L"    "E"    "R"
## Glyma.10G021500.2 "V"    "N"    "L"    "S"    "A"    "L"    "E"    "R"
## Glyma.08G059500.6 "V"    "N"    "F"    "D"    "A"    "L"    "E"    "K"
## Glyma.07G189800.5 "V"    "N"    "F"    "D"    "A"    "L"    "E"    "K"
## Glyma.11G227300.1 "V"    "K"    "I"    "Q"    "D"    "L"    "E"    "L"
## Glyma.14G179500.1 "I"    "N"    "F"    "E"    "A"    "L"    "E"    "G"
## Glyma.14G062100.1 "V"    "R"    "I"    "Q"    "D"    "L"    "E"    "L"
## Glyma.06G095400.1 "V"    "N"    "F"    "D"    "A"    "L"    "E"    "R"
## Glyma.03G209400.1 "V"    "S"    "L"    "S"    "A"    "L"    "E"    "R"
## Glyma.19G100200.1 "V"    "S"    "L"    "G"    "A"    "L"    "E"    "R"
## Glyma.19G206800.1 "V"    "S"    "L"    "S"    "A"    "L"    "E"    "R"
## Glyma.18G030200.1 "V"    "K"    "I"    "E"    "D"    "L"    "E"    "L"
##                   [,214] [,215] [,216] [,217] [,218] [,219] [,220] [,221]
## Glyma.16G050500.1 "L"    "V"    "A"    "R"    "S"    "P"    "Y"    "L"
## Glyma.16G146400.1 "L"    "V"    "A"    "R"    "S"    "P"    "N"    "L"
## Glyma.04G093500.1 "L"    "V"    "A"    "R"    "S"    "P"    "S"    "L"
## Glyma.02G065300.1 "L"    "V"    "A"    "R"    "S"    "P"    "N"    "L"
## Glyma.02G211800.1 "L"    "V"    "A"    "R"    "S"    "P"    "R"    "L"
## Glyma.02G254300.1 "I"    "A"    "R"    "N"    "C"    "P"    "N"    "L"
## Glyma.02G152800.2 "L"    "V"    "S"    "R"    "C"    "P"    "N"    "L"
## Glyma.10G021500.2 "L"    "V"    "S"    "R"    "C"    "P"    "N"    "L"
## Glyma.08G059500.6 "L"    "V"    "C"    "R"    "C"    "K"    "S"    "L"
## Glyma.07G189800.5 "L"    "V"    "S"    "R"    "C"    "K"    "S"    "L"
## Glyma.11G227300.1 "L"    "A"    "K"    "N"    "C"    "P"    "N"    "L"
## Glyma.14G179500.1 "L"    "V"    "A"    "R"    "S"    "P"    "R"    "L"
## Glyma.14G062100.1 "I"    "A"    "R"    "N"    "C"    "P"    "N"    "L"
## Glyma.06G095400.1 "L"    "V"    "A"    "R"    "S"    "P"    "L"    "L"
## Glyma.03G209400.1 "L"    "L"    "G"    "R"    "C"    "R"    "N"    "L"
## Glyma.19G100200.1 "F"    "V"    "A"    "R"    "S"    "P"    "N"    "L"
## Glyma.19G206800.1 "L"    "L"    "G"    "R"    "C"    "P"    "N"    "L"
## Glyma.18G030200.1 "L"    "A"    "K"    "N"    "C"    "P"    "N"    "L"
##                   [,222] [,223] [,224] [,225] [,226] [,227] [,228] [,229]
## Glyma.16G050500.1 "K"    "S"    "L"    "K"    "L"    "N"    "R"    "S"
## Glyma.16G146400.1 "K"    "S"    "L"    "R"    "L"    "N"    "H"    "T"
## Glyma.04G093500.1 "R"    "K"    "L"    "R"    "L"    "N"    "R"    "Y"
## Glyma.02G065300.1 "K"    "S"    "L"    "R"    "L"    "N"    "H"    "T"
## Glyma.02G211800.1 "K"    "K"    "L"    "R"    "L"    "N"    "Q"    "F"
## Glyma.02G254300.1 "N"    "S"    "V"    "K"    "I"    "T"    "D"    "C"
## Glyma.02G152800.2 "Q"    "T"    "L"    "R"    "L"    "N"    "R"    "A"
## Glyma.10G021500.2 "Q"    "T"    "L"    "R"    "L"    "N"    "R"    "A"
## Glyma.08G059500.6 "K"    "T"    "L"    "K"    "V"    "N"    "K"    "S"
## Glyma.07G189800.5 "K"    "T"    "L"    "K"    "V"    "N"    "K"    "S"
## Glyma.11G227300.1 "V"    "S"    "V"    "K"    "L"    "T"    "D"    "S"
## Glyma.14G179500.1 "K"    "K"    "L"    "R"    "L"    "N"    "R"    "Y"
## Glyma.14G062100.1 "N"    "S"    "V"    "K"    "I"    "T"    "D"    "C"
## Glyma.06G095400.1 "R"    "K"    "L"    "R"    "L"    "N"    "R"    "Y"
## Glyma.03G209400.1 "R"    "T"    "L"    "R"    "L"    "N"    "R"    "A"
## Glyma.19G100200.1 "K"    "S"    "L"    "K"    "L"    "N"    "R"    "S"
## Glyma.19G206800.1 "R"    "T"    "L"    "R"    "L"    "N"    "R"    "A"
## Glyma.18G030200.1 "V"    "S"    "V"    "K"    "L"    "T"    "D"    "C"
```

```
##                   [,230] [,231] [,232] [,233] [,234] [,235] [,236] [,237]
## Glyma.16G050500.1 "V"    "P"    "F"    "D"    "L"    "Q"    "R"    "I"
## Glyma.16G146400.1 "V"    "P"    "L"    "S"    "L"    "Q"    "R"    "I"
## Glyma.04G093500.1 "V"    "S"    "M"    "S"    "L"    "H"    "R"    "L"
## Glyma.02G065300.1 "V"    "P"    "L"    "N"    "L"    "Q"    "R"    "I"
## Glyma.02G211800.1 "V"    "S"    "M"    "A"    "L"    "Y"    "R"    "L"
## Glyma.02G254300.1 "E"    "V"    "L"    "D"    "L"    "V"    "N"    "F"
## Glyma.02G152800.2 "V"    "P"    "L"    "D"    "L"    "A"    "T"    "L"
## Glyma.10G021500.2 "V"    "P"    "L"    "D"    "L"    "A"    "N"    "L"
## Glyma.08G059500.6 "V"    "T"    "L"    "E"    "L"    "Q"    "R"    "L"
## Glyma.07G189800.5 "V"    "T"    "L"    "E"    "L"    "Q"    "R"    "L"
## Glyma.11G227300.1 "E"    "I"    "L"    "D"    "L"    "V"    "N"    "F"
## Glyma.14G179500.1 "V"    "S"    "M"    "A"    "L"    "Y"    "R"    "L"
## Glyma.14G062100.1 "E"    "V"    "L"    "D"    "L"    "V"    "N"    "F"
## Glyma.06G095400.1 "V"    "S"    "M"    "S"    "L"    "H"    "R"    "L"
## Glyma.03G209400.1 "V"    "P"    "L"    "D"    "L"    "P"    "N"    "L"
## Glyma.19G100200.1 "V"    "P"    "V"    "D"    "L"    "Q"    "R"    "I"
## Glyma.19G206800.1 "V"    "P"    "L"    "D"    "L"    "P"    "N"    "L"
## Glyma.18G030200.1 "E"    "I"    "L"    "D"    "L"    "V"    "N"    "F"
##                   [,238] [,239] [,240] [,241] [,242] [,243] [,244] [,245]
## Glyma.16G050500.1 "M"    "M"    "R"    "A"    "P"    "Q"    "L"    "S"
## Glyma.16G146400.1 "L"    "M"    "Q"    "A"    "P"    "Q"    "L"    "V"
## Glyma.04G093500.1 "M"    "H"    "R"    "A"    "P"    "Q"    "L"    "T"
## Glyma.02G065300.1 "L"    "R"    "R"    "A"    "P"    "Q"    "I"    "V"
## Glyma.02G211800.1 "L"    "L"    "R"    "A"    "P"    "Q"    "L"    "T"
## Glyma.02G254300.1 "F"    "Q"    "Y"    "A"    "S"    "A"    "L"    "E"
## Glyma.02G152800.2 "L"    "R"    "G"    "A"    "P"    "Q"    "L"    "V"
## Glyma.10G021500.2 "L"    "R"    "G"    "A"    "P"    "Q"    "L"    "V"
## Glyma.08G059500.6 "L"    "V"    "H"    "V"    "P"    "Q"    "L"    "G"
## Glyma.07G189800.5 "I"    "V"    "H"    "V"    "P"    "Q"    "L"    "G"
## Glyma.11G227300.1 "F"    "K"    "H"    "A"    "S"    "A"    "L"    "E"
## Glyma.14G179500.1 "L"    "L"    "R"    "A"    "P"    "Q"    "L"    "T"
## Glyma.14G062100.1 "F"    "R"    "Y"    "A"    "S"    "A"    "L"    "E"
## Glyma.06G095400.1 "M"    "H"    "R"    "A"    "P"    "Q"    "L"    "T"
## Glyma.03G209400.1 "L"    "L"    "R"    "C"    "P"    "Q"    "L"    "V"
## Glyma.19G100200.1 "M"    "M"    "R"    "A"    "P"    "Q"    "L"    "S"
## Glyma.19G206800.1 "L"    "L"    "Q"    "C"    "P"    "Q"    "L"    "V"
## Glyma.18G030200.1 "F"    "K"    "H"    "A"    "S"    "A"    "L"    "E"
##                   [,246] [,247] [,248] [,249] [,250] [,251] [,252] [,253]
## Glyma.16G050500.1 "D"    "L"    "G"    "I"    "G"    "S"    "F"    "V"
## Glyma.16G146400.1 "D"    "L"    "G"    "I"    "G"    "S"    "F"    "V"
## Glyma.04G093500.1 "H"    "L"    "G"    "T"    "G"    "S"    "F"    "S"
## Glyma.02G065300.1 "D"    "L"    "G"    "I"    "G"    "S"    "F"    "I"
## Glyma.02G211800.1 "H"    "L"    "G"    "T"    "G"    "S"    "F"    "S"
## Glyma.02G254300.1 "E"    "F"    "S"    "G"    "G"    "S"    "Y"    "N"
## Glyma.02G152800.2 "E"    "L"    "G"    "T"    "G"    "A"    "Y"    "T"
## Glyma.10G021500.2 "E"    "L"    "G"    "T"    "G"    "T"    "Y"    "T"
## Glyma.08G059500.6 "E"    "L"    "G"    "T"    "G"    "S"    "F"    "S"
## Glyma.07G189800.5 "E"    "L"    "G"    "T"    "G"    "S"    "F"    "S"
## Glyma.11G227300.1 "E"    "F"    "C"    "G"    "G"    "T"    "Y"    "N"
## Glyma.14G179500.1 "H"    "L"    "G"    "T"    "G"    "S"    "F"    "S"
## Glyma.14G062100.1 "E"    "F"    "C"    "G"    "G"    "S"    "Y"    "N"
## Glyma.06G095400.1 "H"    "L"    "G"    "T"    "G"    "S"    "F"    "S"
## Glyma.03G209400.1 "E"    "L"    "G"    "T"    "G"    "V"    "Y"    "S"
```

```
## Glyma.19G100200.1 "D"    "L"    "G"    "I"    "G"    "S"    "L"    "V"
## Glyma.19G206800.1 "E"    "L"    "G"    "T"    "G"    "V"    "Y"    "S"
## Glyma.18G030200.1 "E"    "F"    "C"    "G"    "G"    "T"    "Y"    "N"
##                   [,254] [,255] [,256] [,257] [,258] [,259] [,260] [,261]
## Glyma.16G050500.1 "H"    "D"    "P"    "E"    "S"    "E"    "A"    "Y"
## Glyma.16G146400.1 "F"    "D"    "P"    "R"    "S"    "E"    "V"    "Y"
## Glyma.04G093500.1 "A"    "S"    "E"    "L"    "D"    "-"    "Q"    "E"
## Glyma.02G065300.1 "P"    "D"    "P"    "N"    "S"    "N"    "V"    "F"
## Glyma.02G211800.1 "A"    "T"    "E"    "A"    "G"    "V"    "Q"    "E"
## Glyma.02G254300.1 "E"    "E"    "S"    "E"    "K"    "Y"    "S"    "A"
## Glyma.02G152800.2 "T"    "E"    "M"    "R"    "P"    "E"    "V"    "F"
## Glyma.10G021500.2 "T"    "E"    "M"    "R"    "P"    "E"    "V"    "F"
## Glyma.08G059500.6 "Q"    "E"    "L"    "T"    "A"    "Q"    "Q"    "C"
## Glyma.07G189800.5 "Q"    "E"    "L"    "T"    "S"    "Q"    "Q"    "C"
## Glyma.11G227300.1 "E"    "E"    "P"    "E"    "K"    "Y"    "S"    "A"
## Glyma.14G179500.1 "A"    "T"    "E"    "A"    "G"    "A"    "Q"    "E"
## Glyma.14G062100.1 "E"    "E"    "S"    "E"    "K"    "Y"    "S"    "A"
## Glyma.06G095400.1 "A"    "S"    "E"    "L"    "D"    "-"    "Q"    "E"
## Glyma.03G209400.1 "T"    "E"    "M"    "R"    "P"    "E"    "V"    "F"
## Glyma.19G100200.1 "H"    "D"    "P"    "E"    "S"    "E"    "A"    "Y"
## Glyma.19G206800.1 "T"    "E"    "M"    "R"    "P"    "E"    "V"    "F"
## Glyma.18G030200.1 "E"    "E"    "P"    "E"    "R"    "Y"    "S"    "A"
##                   [,262] [,263] [,264] [,265] [,266] [,267] [,268] [,269]
## Glyma.16G050500.1 "I"    "K"    "L"    "K"    "N"    "T"    "I"    "L"
## Glyma.16G146400.1 "N"    "N"    "M"    "K"    "N"    "A"    "I"    "L"
## Glyma.04G093500.1 "L"    "D"    "F"    "A"    "S"    "A"    "F"    "A"
## Glyma.02G065300.1 "I"    "K"    "L"    "M"    "N"    "T"    "I"    "I"
## Glyma.02G211800.1 "P"    "D"    "Y"    "A"    "A"    "A"    "F"    "E"
## Glyma.02G254300.1 "M"    "S"    "L"    "P"    "A"    "K"    "L"    "S"
## Glyma.02G152800.2 "T"    "N"    "L"    "A"    "E"    "A"    "F"    "S"
## Glyma.10G021500.2 "T"    "N"    "L"    "A"    "E"    "A"    "F"    "S"
## Glyma.08G059500.6 "S"    "D"    "L"    "E"    "S"    "A"    "F"    "K"
## Glyma.07G189800.5 "S"    "D"    "L"    "E"    "S"    "A"    "L"    "K"
## Glyma.11G227300.1 "I"    "S"    "L"    "P"    "A"    "K"    "L"    "C"
## Glyma.14G179500.1 "P"    "D"    "Y"    "A"    "A"    "A"    "F"    "E"
## Glyma.14G062100.1 "I"    "S"    "L"    "P"    "A"    "K"    "L"    "S"
## Glyma.06G095400.1 "L"    "D"    "F"    "A"    "S"    "A"    "F"    "A"
## Glyma.03G209400.1 "S"    "N"    "L"    "E"    "A"    "A"    "F"    "S"
## Glyma.19G100200.1 "I"    "K"    "L"    "K"    "N"    "T"    "I"    "L"
## Glyma.19G206800.1 "S"    "N"    "L"    "E"    "A"    "A"    "F"    "S"
## Glyma.18G030200.1 "I"    "S"    "L"    "P"    "A"    "K"    "L"    "C"
##                   [,270] [,271] [,272] [,273] [,274] [,275] [,276] [,277]
## Glyma.16G050500.1 "K"    "S"    "G"    "F"    "L"    "E"    "V"    "A"
## Glyma.16G146400.1 "K"    "S"    "G"    "F"    "F"    "W"    "V"    "Y"
## Glyma.04G093500.1 "A"    "S"    "G"    "F"    "R"    "E"    "I"    "W"
## Glyma.02G065300.1 "E"    "S"    "G"    "F"    "F"    "E"    "V"    "T"
## Glyma.02G211800.1 "A"    "S"    "G"    "F"    "R"    "E"    "I"    "W"
## Glyma.02G254300.1 "R"    "L"    "G"    "L"    "T"    "Y"    "I"    "T"
## Glyma.02G152800.2 "G"    "S"    "G"    "F"    "W"    "D"    "V"    "L"
## Glyma.10G021500.2 "G"    "S"    "G"    "F"    "W"    "D"    "V"    "L"
## Glyma.08G059500.6 "N"    "S"    "G"    "L"    "W"    "V"    "A"    "T"
## Glyma.07G189800.5 "N"    "S"    "G"    "L"    "W"    "V"    "A"    "T"
## Glyma.11G227300.1 "R"    "L"    "G"    "L"    "T"    "Y"    "I"    "G"
## Glyma.14G179500.1 "A"    "S"    "G"    "F"    "R"    "E"    "I"    "W"
```

```
## Glyma.14G062100.1 "R"    "L"    "G"    "L"    "T"    "Y"    "I"    "T"
## Glyma.06G095400.1 "S"    "S"    "G"    "F"    "R"    "E"    "F"    "W"
## Glyma.03G209400.1 "G"    "S"    "G"    "F"    "W"    "D"    "V"    "L"
## Glyma.19G100200.1 "K"    "S"    "G"    "F"    "L"    "E"    "V"    "A"
## Glyma.19G206800.1 "G"    "S"    "G"    "F"    "W"    "D"    "V"    "L"
## Glyma.18G030200.1 "R"    "L"    "G"    "L"    "T"    "Y"    "I"    "G"
##                   [,278] [,279] [,280] [,281] [,282] [,283] [,284] [,285]
## Glyma.16G050500.1 "P"    "H"    "C"    "L"    "A"    "A"    "I"    "Y"
## Glyma.16G146400.1 "P"    "H"    "C"    "L"    "S"    "A"    "L"    "Y"
## Glyma.04G093500.1 "P"    "D"    "Y"    "L"    "P"    "A"    "I"    "Y"
## Glyma.02G065300.1 "P"    "R"    "C"    "L"    "P"    "A"    "I"    "Y"
## Glyma.02G211800.1 "A"    "D"    "Y"    "L"    "P"    "A"    "I"    "Y"
## Glyma.02G254300.1 "K"    "N"    "E"    "M"    "P"    "I"    "V"    "F"
## Glyma.02G152800.2 "P"    "S"    "Y"    "L"    "P"    "A"    "V"    "Y"
## Glyma.10G021500.2 "P"    "S"    "Y"    "L"    "P"    "A"    "V"    "Y"
## Glyma.08G059500.6 "A"    "Q"    "Y"    "L"    "P"    "V"    "L"    "Y"
## Glyma.07G189800.5 "A"    "Q"    "Y"    "L"    "P"    "V"    "L"    "Y"
## Glyma.11G227300.1 "K"    "N"    "E"    "L"    "P"    "I"    "V"    "F"
## Glyma.14G179500.1 "A"    "D"    "Y"    "L"    "P"    "A"    "I"    "Y"
## Glyma.14G062100.1 "K"    "N"    "E"    "M"    "P"    "M"    "V"    "F"
## Glyma.06G095400.1 "A"    "D"    "Y"    "L"    "P"    "A"    "I"    "Y"
## Glyma.03G209400.1 "P"    "S"    "Y"    "L"    "P"    "A"    "V"    "Y"
## Glyma.19G100200.1 "P"    "H"    "C"    "L"    "A"    "A"    "I"    "Y"
## Glyma.19G206800.1 "P"    "S"    "Y"    "L"    "P"    "A"    "V"    "Y"
## Glyma.18G030200.1 "K"    "N"    "E"    "L"    "P"    "I"    "V"    "F"
##                   [,286] [,287] [,288] [,289] [,290] [,291] [,292] [,293]
## Glyma.16G050500.1 "P"    "I"    "C"    "P"    "N"    "L"    "T"    "S"
## Glyma.16G146400.1 "P"    "V"    "C"    "M"    "N"    "L"    "T"    "T"
## Glyma.04G093500.1 "P"    "A"    "C"    "A"    "N"    "L"    "I"    "S"
## Glyma.02G065300.1 "P"    "V"    "C"    "M"    "N"    "L"    "T"    "A"
## Glyma.02G211800.1 "P"    "V"    "C"    "A"    "N"    "L"    "T"    "S"
## Glyma.02G254300.1 "P"    "Y"    "A"    "A"    "L"    "L"    "K"    "K"
## Glyma.02G152800.2 "P"    "I"    "C"    "S"    "N"    "L"    "T"    "S"
## Glyma.10G021500.2 "P"    "I"    "C"    "S"    "N"    "L"    "T"    "S"
## Glyma.08G059500.6 "S"    "A"    "C"    "T"    "N"    "L"    "T"    "F"
## Glyma.07G189800.5 "S"    "A"    "C"    "T"    "N"    "L"    "T"    "F"
## Glyma.11G227300.1 "M"    "F"    "A"    "A"    "V"    "L"    "K"    "K"
## Glyma.14G179500.1 "P"    "V"    "C"    "T"    "N"    "L"    "T"    "S"
## Glyma.14G062100.1 "P"    "Y"    "A"    "A"    "L"    "L"    "K"    "K"
## Glyma.06G095400.1 "P"    "A"    "C"    "A"    "N"    "L"    "I"    "S"
## Glyma.03G209400.1 "P"    "I"    "C"    "S"    "R"    "L"    "T"    "S"
## Glyma.19G100200.1 "P"    "I"    "C"    "P"    "N"    "L"    "T"    "S"
## Glyma.19G206800.1 "P"    "I"    "C"    "S"    "R"    "L"    "T"    "S"
## Glyma.18G030200.1 "M"    "F"    "A"    "A"    "V"    "L"    "K"    "K"
##                   [,294] [,295] [,296] [,297] [,298] [,299] [,300] [,301]
## Glyma.16G050500.1 "L"    "N"    "L"    "S"    "Y"    "A"    "A"    "I"
## Glyma.16G146400.1 "L"    "N"    "L"    "R"    "F"    "A"    "A"    "I"
## Glyma.04G093500.1 "L"    "N"    "F"    "S"    "Y"    "A"    "D"    "I"
## Glyma.02G065300.1 "M"    "N"    "L"    "S"    "Y"    "A"    "A"    "I"
## Glyma.02G211800.1 "L"    "N"    "L"    "S"    "Y"    "A"    "D"    "I"
## Glyma.02G254300.1 "L"    "D"    "L"    "L"    "Y"    "A"    "M"    "L"
## Glyma.02G152800.2 "L"    "N"    "L"    "S"    "Y"    "A"    "T"    "I"
## Glyma.10G021500.2 "L"    "N"    "L"    "S"    "Y"    "A"    "T"    "I"
## Glyma.08G059500.6 "L"    "N"    "F"    "S"    "Y"    "A"    "P"    "L"
```

```
## Glyma.07G189800.5 "L"    "N"    "F"    "S"    "Y"    "A"    "P"    "L"
## Glyma.11G227300.1 "L"    "D"    "L"    "L"    "Y"    "A"    "M"    "L"
## Glyma.14G179500.1 "L"    "N"    "L"    "S"    "Y"    "A"    "D"    "V"
## Glyma.14G062100.1 "L"    "D"    "L"    "L"    "Y"    "A"    "M"    "L"
## Glyma.06G095400.1 "L"    "N"    "F"    "S"    "F"    "A"    "D"    "I"
## Glyma.03G209400.1 "L"    "N"    "L"    "S"    "Y"    "A"    "I"    "I"
## Glyma.19G100200.1 "L"    "N"    "L"    "S"    "Y"    "A"    "A"    "I"
## Glyma.19G206800.1 "L"    "N"    "L"    "S"    "Y"    "A"    "I"    "I"
## Glyma.18G030200.1 "L"    "D"    "L"    "L"    "Y"    "A"    "M"    "L"
##                   [,302] [,303] [,304] [,305] [,306] [,307] [,308] [,309]
## Glyma.16G050500.1 "Q"    "G"    "S"    "D"    "L"    "I"    "K"    "L"
## Glyma.16G146400.1 "Q"    "N"    "T"    "E"    "L"    "I"    "K"    "L"
## Glyma.04G093500.1 "S"    "A"    "D"    "Q"    "L"    "I"    "S"    "V"
## Glyma.02G065300.1 "Q"    "S"    "R"    "E"    "L"    "I"    "K"    "L"
## Glyma.02G211800.1 "N"    "T"    "D"    "Q"    "L"    "K"    "S"    "V"
## Glyma.02G254300.1 "D"    "T"    "E"    "D"    "H"    "C"    "T"    "L"
## Glyma.02G152800.2 "Q"    "S"    "P"    "D"    "L"    "I"    "K"    "L"
## Glyma.10G021500.2 "Q"    "S"    "P"    "D"    "L"    "I"    "K"    "L"
## Glyma.08G059500.6 "D"    "S"    "D"    "G"    "L"    "A"    "K"    "L"
## Glyma.07G189800.5 "D"    "S"    "D"    "G"    "L"    "T"    "K"    "L"
## Glyma.11G227300.1 "D"    "T"    "E"    "D"    "H"    "C"    "M"    "L"
## Glyma.14G179500.1 "N"    "T"    "D"    "Q"    "L"    "K"    "S"    "V"
## Glyma.14G062100.1 "D"    "T"    "E"    "D"    "H"    "C"    "T"    "L"
## Glyma.06G095400.1 "S"    "A"    "D"    "Q"    "L"    "K"    "S"    "V"
## Glyma.03G209400.1 "Q"    "S"    "S"    "D"    "L"    "I"    "K"    "L"
## Glyma.19G100200.1 "Q"    "G"    "S"    "A"    "L"    "V"    "K"    "L"
## Glyma.19G206800.1 "Q"    "S"    "S"    "D"    "L"    "I"    "K"    "L"
## Glyma.18G030200.1 "D"    "T"    "E"    "D"    "H"    "C"    "M"    "L"
##                   [,310] [,311] [,312] [,313] [,314] [,315] [,316] [,317]
## Glyma.16G050500.1 "I"    "R"    "H"    "C"    "V"    "K"    "L"    "Q"
## Glyma.16G146400.1 "I"    "C"    "C"    "C"    "G"    "K"    "L"    "Q"
## Glyma.04G093500.1 "I"    "R"    "H"    "C"    "H"    "K"    "L"    "Q"
## Glyma.02G065300.1 "I"    "C"    "R"    "C"    "G"    "K"    "L"    "Q"
## Glyma.02G211800.1 "I"    "C"    "H"    "C"    "H"    "K"    "L"    "Q"
## Glyma.02G254300.1 "I"    "Q"    "R"    "C"    "P"    "N"    "L"    "E"
## Glyma.02G152800.2 "V"    "G"    "Q"    "C"    "E"    "S"    "L"    "Q"
## Glyma.10G021500.2 "V"    "G"    "Q"    "C"    "E"    "S"    "L"    "Q"
## Glyma.08G059500.6 "L"    "V"    "H"    "C"    "P"    "K"    "L"    "Q"
## Glyma.07G189800.5 "L"    "V"    "H"    "C"    "P"    "K"    "L"    "Q"
## Glyma.11G227300.1 "I"    "Q"    "K"    "C"    "P"    "N"    "L"    "E"
## Glyma.14G179500.1 "I"    "R"    "H"    "C"    "H"    "K"    "L"    "Q"
## Glyma.14G062100.1 "I"    "Q"    "R"    "C"    "P"    "N"    "L"    "E"
## Glyma.06G095400.1 "I"    "R"    "H"    "C"    "H"    "K"    "L"    "Q"
## Glyma.03G209400.1 "I"    "S"    "Q"    "C"    "P"    "N"    "L"    "L"
## Glyma.19G100200.1 "I"    "H"    "H"    "C"    "V"    "K"    "L"    "Q"
## Glyma.19G206800.1 "I"    "S"    "Q"    "C"    "P"    "N"    "L"    "L"
## Glyma.18G030200.1 "I"    "Q"    "R"    "C"    "P"    "N"    "L"    "E"
##                   [,318] [,319] [,320] [,321] [,322] [,323] [,324] [,325]
## Glyma.16G050500.1 "R"    "L"    "L"    "I"    "M"    "D"    "C"    "I"
## Glyma.16G146400.1 "R"    "L"    "S"    "I"    "M"    "D"    "C"    "I"
## Glyma.04G093500.1 "T"    "F"    "W"    "V"    "L"    "D"    "T"    "I"
## Glyma.02G065300.1 "R"    "L"    "W"    "I"    "M"    "D"    "C"    "I"
## Glyma.02G211800.1 "I"    "F"    "W"    "V"    "L"    "D"    "S"    "I"
## Glyma.02G254300.1 "V"    "L"    "E"    "S"    "R"    "N"    "V"    "I"
```

```
## Glyma.02G152800.2 "R"    "L"    "W"    "V"    "L"    "D"    "Y"    "I"
## Glyma.10G021500.2 "R"    "L"    "W"    "V"    "L"    "D"    "Y"    "I"
## Glyma.08G059500.6 "R"    "I"    "W"    "V"    "V"    "D"    "T"    "V"
## Glyma.07G189800.5 "R"    "L"    "W"    "V"    "V"    "D"    "T"    "V"
## Glyma.11G227300.1 "V"    "L"    "E"    "T"    "R"    "N"    "V"    "I"
## Glyma.14G179500.1 "I"    "F"    "W"    "V"    "L"    "D"    "S"    "I"
## Glyma.14G062100.1 "V"    "L"    "E"    "S"    "R"    "N"    "V"    "I"
## Glyma.06G095400.1 "T"    "F"    "W"    "V"    "L"    "D"    "T"    "I"
## Glyma.03G209400.1 "R"    "L"    "W"    "V"    "L"    "D"    "Y"    "I"
## Glyma.19G100200.1 "R"    "L"    "W"    "I"    "M"    "D"    "C"    "I"
## Glyma.19G206800.1 "R"    "L"    "W"    "V"    "L"    "D"    "Y"    "I"
## Glyma.18G030200.1 "V"    "L"    "E"    "T"    "R"    "N"    "V"    "I"
##                   [,326] [,327] [,328] [,329] [,330] [,331] [,332] [,333]
## Glyma.16G050500.1 "G"    "D"    "K"    "G"    "L"    "D"    "V"    "V"
## Glyma.16G146400.1 "G"    "D"    "N"    "G"    "L"    "G"    "V"    "V"
## Glyma.04G093500.1 "C"    "D"    "E"    "G"    "L"    "Q"    "A"    "V"
## Glyma.02G065300.1 "G"    "D"    "F"    "G"    "L"    "H"    "V"    "V"
## Glyma.02G211800.1 "R"    "D"    "E"    "G"    "L"    "Q"    "A"    "V"
## Glyma.02G254300.1 "G"    "D"    "R"    "G"    "L"    "E"    "V"    "L"
## Glyma.02G152800.2 "E"    "D"    "A"    "G"    "L"    "E"    "V"    "I"
## Glyma.10G021500.2 "E"    "D"    "A"    "G"    "L"    "E"    "V"    "I"
## Glyma.08G059500.6 "E"    "D"    "K"    "G"    "L"    "E"    "A"    "V"
## Glyma.07G189800.5 "E"    "D"    "K"    "G"    "L"    "E"    "A"    "V"
## Glyma.11G227300.1 "G"    "D"    "R"    "G"    "L"    "E"    "V"    "L"
## Glyma.14G179500.1 "R"    "D"    "E"    "G"    "L"    "Q"    "A"    "V"
## Glyma.14G062100.1 "G"    "D"    "R"    "G"    "L"    "E"    "V"    "L"
## Glyma.06G095400.1 "C"    "D"    "E"    "G"    "L"    "Q"    "A"    "V"
## Glyma.03G209400.1 "E"    "D"    "A"    "G"    "L"    "Y"    "A"    "L"
## Glyma.19G100200.1 "G"    "D"    "K"    "G"    "L"    "G"    "V"    "V"
## Glyma.19G206800.1 "E"    "D"    "A"    "G"    "L"    "Y"    "A"    "L"
## Glyma.18G030200.1 "G"    "D"    "R"    "G"    "L"    "E"    "V"    "L"
##                   [,334] [,335] [,336] [,337] [,338] [,339] [,340] [,341]
## Glyma.16G050500.1 "A"    "T"    "S"    "C"    "K"    "D"    "L"    "Q"
## Glyma.16G146400.1 "A"    "A"    "T"    "C"    "K"    "D"    "L"    "Q"
## Glyma.04G093500.1 "A"    "E"    "T"    "C"    "K"    "D"    "L"    "R"
## Glyma.02G065300.1 "A"    "S"    "T"    "C"    "K"    "D"    "L"    "Q"
## Glyma.02G211800.1 "A"    "A"    "T"    "C"    "K"    "D"    "L"    "R"
## Glyma.02G254300.1 "A"    "R"    "C"    "C"    "R"    "R"    "L"    "K"
## Glyma.02G152800.2 "A"    "A"    "S"    "C"    "K"    "D"    "L"    "R"
## Glyma.10G021500.2 "A"    "A"    "S"    "C"    "K"    "D"    "L"    "R"
## Glyma.08G059500.6 "G"    "S"    "H"    "C"    "P"    "L"    "L"    "E"
## Glyma.07G189800.5 "G"    "S"    "H"    "C"    "P"    "L"    "L"    "E"
## Glyma.11G227300.1 "G"    "R"    "C"    "C"    "K"    "R"    "L"    "K"
## Glyma.14G179500.1 "A"    "A"    "T"    "C"    "K"    "D"    "L"    "R"
## Glyma.14G062100.1 "A"    "R"    "C"    "C"    "R"    "R"    "L"    "K"
## Glyma.06G095400.1 "A"    "E"    "T"    "C"    "K"    "D"    "L"    "R"
## Glyma.03G209400.1 "A"    "A"    "S"    "C"    "K"    "D"    "L"    "R"
## Glyma.19G100200.1 "A"    "T"    "T"    "C"    "K"    "D"    "L"    "Q"
## Glyma.19G206800.1 "A"    "A"    "S"    "C"    "K"    "D"    "L"    "R"
## Glyma.18G030200.1 "G"    "R"    "C"    "C"    "K"    "R"    "L"    "K"
##                   [,342] [,343] [,344] [,345] [,346] [,347] [,348] [,349]
## Glyma.16G050500.1 "E"    "L"    "R"    "V"    "F"    "P"    "S"    "V"
## Glyma.16G146400.1 "E"    "L"    "R"    "V"    "F"    "P"    "V"    "V"
## Glyma.04G093500.1 "E"    "L"    "R"    "V"    "F"    "P"    "V"    "N"
```

```
## Glyma.02G065300.1 "E"    "L"    "R"    "V"    "F"    "P"    "S"    "V"
## Glyma.02G211800.1 "E"    "L"    "R"    "V"    "F"    "P"    "M"    "D"
## Glyma.02G254300.1 "R"    "I"    "R"    "I"    "E"    "R"    "D"    "D"
## Glyma.02G152800.2 "E"    "L"    "R"    "V"    "F"    "P"    "S"    "D"
## Glyma.10G021500.2 "E"    "L"    "R"    "V"    "F"    "P"    "S"    "D"
## Glyma.08G059500.6 "E"    "L"    "R"    "V"    "F"    "P"    "A"    "D"
## Glyma.07G189800.5 "E"    "L"    "R"    "V"    "F"    "P"    "A"    "D"
## Glyma.11G227300.1 "R"    "L"    "R"    "I"    "E"    "R"    "D"    "D"
## Glyma.14G179500.1 "E"    "L"    "R"    "V"    "F"    "P"    "V"    "D"
## Glyma.14G062100.1 "R"    "L"    "R"    "I"    "E"    "R"    "D"    "D"
## Glyma.06G095400.1 "E"    "L"    "R"    "V"    "F"    "P"    "V"    "N"
## Glyma.03G209400.1 "E"    "L"    "R"    "V"    "F"    "P"    "S"    "E"
## Glyma.19G100200.1 "E"    "L"    "R"    "V"    "F"    "P"    "S"    "V"
## Glyma.19G206800.1 "E"    "L"    "R"    "V"    "F"    "P"    "S"    "D"
## Glyma.18G030200.1 "R"    "L"    "R"    "I"    "E"    "R"    "D"    "D"
##                   [,350] [,351] [,352] [,353] [,354] [,355] [,356] [,357]
## Glyma.16G050500.1 "P"    "G"    "-"    "-"    "N"    "P"    "A"    "A"
## Glyma.16G146400.1 "R"    "G"    "G"    "N"    "G"    "P"    "T"    "R"
## Glyma.04G093500.1 "T"    "R"    "E"    "E"    "I"    "E"    "G"    "P"
## Glyma.02G065300.1 "R"    "G"    "R"    "N"    "D"    "P"    "A"    "G"
## Glyma.02G211800.1 "A"    "R"    "E"    "E"    "T"    "D"    "G"    "P"
## Glyma.02G254300.1 "Q"    "M"    "E"    "D"    "E"    "E"    "G"    "V"
## Glyma.02G152800.2 "P"    "G"    "L"    "E"    "P"    "N"    "V"    "A"
## Glyma.10G021500.2 "P"    "G"    "L"    "E"    "P"    "N"    "V"    "A"
## Glyma.08G059500.6 "P"    "D"    "E"    "G"    "I"    "V"    "H"    "G"
## Glyma.07G189800.5 "P"    "D"    "E"    "G"    "I"    "V"    "H"    "G"
## Glyma.11G227300.1 "Q"    "M"    "E"    "D"    "E"    "E"    "G"    "T"
## Glyma.14G179500.1 "A"    "R"    "E"    "E"    "T"    "D"    "G"    "P"
## Glyma.14G062100.1 "Q"    "M"    "E"    "D"    "E"    "E"    "G"    "V"
## Glyma.06G095400.1 "T"    "R"    "E"    "E"    "I"    "E"    "G"    "P"
## Glyma.03G209400.1 "P"    "G"    "L"    "E"    "P"    "N"    "V"    "S"
## Glyma.19G100200.1 "P"    "G"    "-"    "-"    "D"    "P"    "A"    "A"
## Glyma.19G206800.1 "P"    "G"    "L"    "E"    "P"    "N"    "V"    "A"
## Glyma.18G030200.1 "Q"    "M"    "E"    "D"    "E"    "E"    "G"    "T"
##                   [,358] [,359] [,360] [,361] [,362] [,363] [,364] [,365]
## Glyma.16G050500.1 "V"    "T"    "E"    "K"    "G"    "L"    "V"    "A"
## Glyma.16G146400.1 "V"    "T"    "E"    "K"    "G"    "L"    "V"    "A"
## Glyma.04G093500.1 "V"    "S"    "E"    "V"    "G"    "F"    "E"    "A"
## Glyma.02G065300.1 "V"    "T"    "E"    "K"    "G"    "L"    "V"    "A"
## Glyma.02G211800.1 "V"    "S"    "E"    "V"    "G"    "F"    "E"    "A"
## Glyma.02G254300.1 "V"    "S"    "Q"    "R"    "G"    "L"    "I"    "A"
## Glyma.02G152800.2 "L"    "T"    "E"    "Q"    "G"    "L"    "V"    "S"
## Glyma.10G021500.2 "L"    "T"    "E"    "Q"    "G"    "L"    "V"    "S"
## Glyma.08G059500.6 "V"    "T"    "E"    "S"    "G"    "F"    "I"    "A"
## Glyma.07G189800.5 "V"    "T"    "E"    "S"    "G"    "F"    "I"    "A"
## Glyma.11G227300.1 "V"    "S"    "H"    "R"    "G"    "L"    "I"    "A"
## Glyma.14G179500.1 "V"    "S"    "E"    "V"    "G"    "F"    "E"    "A"
## Glyma.14G062100.1 "V"    "S"    "Q"    "R"    "G"    "L"    "I"    "A"
## Glyma.06G095400.1 "V"    "S"    "E"    "V"    "G"    "F"    "E"    "A"
## Glyma.03G209400.1 "L"    "T"    "E"    "Q"    "G"    "L"    "V"    "S"
## Glyma.19G100200.1 "V"    "T"    "E"    "K"    "G"    "L"    "V"    "A"
## Glyma.19G206800.1 "L"    "T"    "E"    "Q"    "G"    "L"    "V"    "S"
## Glyma.18G030200.1 "V"    "S"    "H"    "R"    "G"    "L"    "I"    "A"
##                   [,366] [,367] [,368] [,369] [,370] [,371] [,372] [,373]
```

```
## Glyma.16G050500.1 "I"    "S"    "M"    "G"    "C"    "P"    "K"    "L"
## Glyma.16G146400.1 "I"    "S"    "M"    "G"    "C"    "P"    "E"    "L"
## Glyma.04G093500.1 "I"    "S"    "R"    "G"    "C"    "R"    "K"    "L"
## Glyma.02G065300.1 "I"    "S"    "M"    "G"    "C"    "P"    "K"    "L"
## Glyma.02G211800.1 "I"    "S"    "Q"    "G"    "C"    "R"    "K"    "L"
## Glyma.02G254300.1 "L"    "S"    "H"    "G"    "C"    "P"    "E"    "L"
## Glyma.02G152800.2 "V"    "S"    "E"    "G"    "C"    "T"    "K"    "L"
## Glyma.10G021500.2 "V"    "S"    "E"    "G"    "C"    "T"    "K"    "L"
## Glyma.08G059500.6 "V"    "S"    "Q"    "G"    "C"    "P"    "R"    "L"
## Glyma.07G189800.5 "V"    "S"    "Q"    "G"    "C"    "P"    "R"    "L"
## Glyma.11G227300.1 "L"    "S"    "Q"    "G"    "C"    "S"    "E"    "L"
## Glyma.14G179500.1 "I"    "S"    "Q"    "G"    "C"    "R"    "K"    "L"
## Glyma.14G062100.1 "L"    "S"    "H"    "G"    "C"    "P"    "E"    "L"
## Glyma.06G095400.1 "I"    "S"    "R"    "G"    "C"    "R"    "K"    "L"
## Glyma.03G209400.1 "V"    "S"    "E"    "G"    "C"    "P"    "K"    "L"
## Glyma.19G100200.1 "I"    "S"    "M"    "G"    "C"    "P"    "K"    "L"
## Glyma.19G206800.1 "V"    "S"    "E"    "G"    "C"    "P"    "K"    "L"
## Glyma.18G030200.1 "L"    "S"    "Q"    "G"    "C"    "S"    "E"    "L"
##                   [,374] [,375] [,376] [,377] [,378] [,379] [,380] [,381]
## Glyma.16G050500.1 "H"    "S"    "L"    "L"    "Y"    "F"    "C"    "H"
## Glyma.16G146400.1 "H"    "S"    "L"    "L"    "Y"    "F"    "C"    "Q"
## Glyma.04G093500.1 "Q"    "S"    "I"    "L"    "F"    "F"    "C"    "Q"
## Glyma.02G065300.1 "H"    "S"    "L"    "L"    "Y"    "F"    "C"    "Q"
## Glyma.02G211800.1 "E"    "S"    "I"    "L"    "F"    "L"    "C"    "Q"
## Glyma.02G254300.1 "E"    "Y"    "L"    "A"    "V"    "Y"    "V"    "S"
## Glyma.02G152800.2 "Q"    "S"    "V"    "L"    "Y"    "F"    "C"    "R"
## Glyma.10G021500.2 "Q"    "S"    "V"    "L"    "Y"    "F"    "C"    "R"
## Glyma.08G059500.6 "H"    "Y"    "V"    "L"    "Y"    "F"    "C"    "R"
## Glyma.07G189800.5 "H"    "Y"    "V"    "L"    "Y"    "F"    "C"    "R"
## Glyma.11G227300.1 "E"    "Y"    "M"    "A"    "V"    "Y"    "V"    "S"
## Glyma.14G179500.1 "E"    "S"    "I"    "L"    "F"    "F"    "T"    "Q"
## Glyma.14G062100.1 "E"    "Y"    "L"    "A"    "V"    "Y"    "V"    "S"
## Glyma.06G095400.1 "Q"    "S"    "I"    "L"    "F"    "F"    "C"    "Q"
## Glyma.03G209400.1 "Q"    "S"    "V"    "L"    "Y"    "F"    "C"    "R"
## Glyma.19G100200.1 "H"    "S"    "L"    "L"    "Y"    "F"    "C"    "H"
## Glyma.19G206800.1 "Q"    "S"    "V"    "L"    "Y"    "F"    "C"    "R"
## Glyma.18G030200.1 "E"    "Y"    "M"    "A"    "V"    "Y"    "V"    "S"
##                   [,382] [,383] [,384] [,385] [,386] [,387] [,388] [,389]
## Glyma.16G050500.1 "Q"    "M"    "T"    "N"    "A"    "A"    "L"    "I"
## Glyma.16G146400.1 "Q"    "M"    "T"    "N"    "A"    "A"    "L"    "I"
## Glyma.04G093500.1 "R"    "M"    "T"    "N"    "A"    "A"    "V"    "V"
## Glyma.02G065300.1 "Q"    "M"    "T"    "N"    "A"    "A"    "L"    "I"
## Glyma.02G211800.1 "R"    "M"    "T"    "N"    "A"    "A"    "V"    "V"
## Glyma.02G254300.1 "D"    "I"    "T"    "N"    "A"    "S"    "L"    "E"
## Glyma.02G152800.2 "Q"    "M"    "S"    "N"    "A"    "A"    "L"    "D"
## Glyma.10G021500.2 "Q"    "M"    "T"    "N"    "S"    "A"    "L"    "D"
## Glyma.08G059500.6 "Q"    "M"    "T"    "N"    "A"    "A"    "V"    "A"
## Glyma.07G189800.5 "Q"    "M"    "T"    "N"    "A"    "A"    "V"    "A"
## Glyma.11G227300.1 "D"    "I"    "T"    "N"    "A"    "S"    "L"    "E"
## Glyma.14G179500.1 "R"    "M"    "T"    "N"    "A"    "A"    "V"    "V"
## Glyma.14G062100.1 "D"    "I"    "T"    "N"    "A"    "S"    "L"    "E"
## Glyma.06G095400.1 "R"    "M"    "T"    "N"    "A"    "A"    "V"    "V"
## Glyma.03G209400.1 "Q"    "M"    "S"    "N"    "A"    "A"    "L"    "H"
## Glyma.19G100200.1 "Q"    "M"    "T"    "N"    "A"    "A"    "L"    "I"
```

```
## Glyma.19G206800.1 "Q"    "M"    "S"    "N"    "A"    "A"    "L"    "H"
## Glyma.18G030200.1 "D"    "I"    "T"    "N"    "A"    "S"    "L"    "E"
##                   [,390] [,391] [,392] [,393] [,394] [,395] [,396] [,397]
## Glyma.16G050500.1 "T"    "V"    "A"    "K"    "N"    "C"    "P"    "N"
## Glyma.16G146400.1 "T"    "V"    "A"    "K"    "N"    "C"    "P"    "N"
## Glyma.04G093500.1 "A"    "M"    "S"    "N"    "N"    "C"    "P"    "D"
## Glyma.02G065300.1 "T"    "V"    "A"    "K"    "N"    "C"    "P"    "N"
## Glyma.02G211800.1 "A"    "M"    "S"    "K"    "N"    "C"    "P"    "D"
## Glyma.02G254300.1 "H"    "I"    "G"    "T"    "H"    "L"    "K"    "N"
## Glyma.02G152800.2 "T"    "I"    "A"    "R"    "S"    "R"    "P"    "N"
## Glyma.10G021500.2 "T"    "I"    "A"    "R"    "N"    "R"    "P"    "N"
## Glyma.08G059500.6 "T"    "V"    "V"    "Q"    "N"    "C"    "P"    "D"
## Glyma.07G189800.5 "T"    "V"    "V"    "Q"    "N"    "C"    "P"    "D"
## Glyma.11G227300.1 "H"    "I"    "G"    "T"    "H"    "L"    "K"    "N"
## Glyma.14G179500.1 "A"    "M"    "S"    "K"    "N"    "C"    "P"    "D"
## Glyma.14G062100.1 "H"    "I"    "G"    "T"    "H"    "L"    "K"    "N"
## Glyma.06G095400.1 "A"    "M"    "S"    "N"    "N"    "C"    "P"    "D"
## Glyma.03G209400.1 "T"    "I"    "A"    "R"    "N"    "R"    "P"    "N"
## Glyma.19G100200.1 "T"    "V"    "A"    "K"    "N"    "C"    "P"    "N"
## Glyma.19G206800.1 "T"    "I"    "A"    "R"    "N"    "R"    "T"    "N"
## Glyma.18G030200.1 "H"    "I"    "G"    "T"    "H"    "L"    "K"    "N"
##                   [,398] [,399] [,400] [,401] [,402] [,403] [,404] [,405]
## Glyma.16G050500.1 "F"    "I"    "R"    "F"    "R"    "L"    "C"    "I"
## Glyma.16G146400.1 "F"    "I"    "R"    "F"    "R"    "L"    "C"    "I"
## Glyma.04G093500.1 "L"    "V"    "V"    "F"    "R"    "L"    "C"    "I"
## Glyma.02G065300.1 "F"    "I"    "R"    "F"    "R"    "L"    "C"    "I"
## Glyma.02G211800.1 "L"    "V"    "V"    "F"    "R"    "L"    "C"    "I"
## Glyma.02G254300.1 "L"    "C"    "D"    "F"    "R"    "L"    "V"    "L"
## Glyma.02G152800.2 "M"    "T"    "R"    "F"    "R"    "L"    "C"    "I"
## Glyma.10G021500.2 "M"    "T"    "R"    "F"    "R"    "L"    "C"    "I"
## Glyma.08G059500.6 "F"    "T"    "H"    "F"    "R"    "L"    "C"    "I"
## Glyma.07G189800.5 "F"    "T"    "H"    "F"    "R"    "L"    "C"    "I"
## Glyma.11G227300.1 "L"    "C"    "D"    "F"    "R"    "L"    "V"    "L"
## Glyma.14G179500.1 "L"    "V"    "V"    "F"    "R"    "L"    "C"    "I"
## Glyma.14G062100.1 "L"    "C"    "D"    "F"    "R"    "L"    "V"    "L"
## Glyma.06G095400.1 "L"    "V"    "V"    "F"    "R"    "L"    "C"    "I"
## Glyma.03G209400.1 "L"    "T"    "R"    "F"    "R"    "L"    "C"    "I"
## Glyma.19G100200.1 "F"    "I"    "R"    "F"    "R"    "L"    "C"    "I"
## Glyma.19G206800.1 "L"    "T"    "R"    "F"    "R"    "L"    "C"    "I"
## Glyma.18G030200.1 "L"    "C"    "D"    "F"    "R"    "L"    "V"    "L"
##                   [,406] [,407] [,408] [,409] [,410] [,411] [,412] [,413]
## Glyma.16G050500.1 "L"    "D"    "A"    "T"    "K"    "P"    "D"    "T"
## Glyma.16G146400.1 "L"    "D"    "P"    "T"    "K"    "P"    "D"    "T"
## Glyma.04G093500.1 "I"    "G"    "R"    "Y"    "R"    "P"    "E"    "T"
## Glyma.02G065300.1 "L"    "D"    "P"    "T"    "K"    "P"    "D"    "T"
## Glyma.02G211800.1 "I"    "G"    "R"    "Y"    "R"    "P"    "V"    "T"
## Glyma.02G254300.1 "L"    "D"    "R"    "E"    "E"    "K"    "I"    "T"
## Glyma.02G152800.2 "I"    "E"    "P"    "R"    "A"    "Y"    "L"    "T"
## Glyma.10G021500.2 "I"    "E"    "P"    "Q"    "A"    "H"    "L"    "T"
## Glyma.08G059500.6 "M"    "H"    "P"    "G"    "Q"    "Y"    "L"    "T"
## Glyma.07G189800.5 "M"    "H"    "P"    "G"    "Q"    "Y"    "L"    "T"
## Glyma.11G227300.1 "L"    "D"    "H"    "E"    "E"    "K"    "I"    "T"
## Glyma.14G179500.1 "I"    "G"    "R"    "Y"    "R"    "P"    "V"    "T"
## Glyma.14G062100.1 "L"    "D"    "R"    "E"    "E"    "K"    "I"    "T"
```

```
## Glyma.06G095400.1 "I"    "G"    "Q"    "Y"    "R"    "P"    "V"    "T"
## Glyma.03G209400.1 "I"    "E"    "P"    "R"    "T"    "Y"    "L"    "T"
## Glyma.19G100200.1 "L"    "D"    "A"    "T"    "K"    "P"    "D"    "T"
## Glyma.19G206800.1 "I"    "E"    "P"    "R"    "T"    "Y"    "L"    "T"
## Glyma.18G030200.1 "L"    "D"    "H"    "E"    "E"    "K"    "I"    "T"
##                   [,414] [,415] [,416] [,417] [,418] [,419] [,420] [,421]
## Glyma.16G050500.1 "M"    "Q"    "P"    "L"    "D"    "E"    "G"    "F"
## Glyma.16G146400.1 "M"    "Q"    "P"    "L"    "N"    "E"    "G"    "F"
## Glyma.04G093500.1 "L"    "E"    "P"    "M"    "D"    "E"    "G"    "F"
## Glyma.02G065300.1 "V"    "Q"    "P"    "L"    "D"    "E"    "G"    "F"
## Glyma.02G211800.1 "Q"    "E"    "P"    "M"    "D"    "E"    "G"    "F"
## Glyma.02G254300.1 "D"    "L"    "P"    "L"    "D"    "N"    "G"    "V"
## Glyma.02G152800.2 "H"    "Q"    "P"    "L"    "D"    "A"    "G"    "F"
## Glyma.10G021500.2 "H"    "Q"    "P"    "L"    "D"    "A"    "G"    "F"
## Glyma.08G059500.6 "Q"    "E"    "S"    "M"    "D"    "E"    "A"    "F"
## Glyma.07G189800.5 "Q"    "E"    "S"    "M"    "D"    "E"    "A"    "F"
## Glyma.11G227300.1 "D"    "L"    "P"    "L"    "D"    "N"    "G"    "V"
## Glyma.14G179500.1 "E"    "E"    "P"    "M"    "D"    "E"    "G"    "F"
## Glyma.14G062100.1 "D"    "L"    "P"    "L"    "D"    "N"    "G"    "V"
## Glyma.06G095400.1 "L"    "E"    "P"    "M"    "D"    "E"    "G"    "F"
## Glyma.03G209400.1 "L"    "E"    "P"    "L"    "D"    "S"    "G"    "F"
## Glyma.19G100200.1 "M"    "Q"    "P"    "L"    "D"    "E"    "G"    "F"
## Glyma.19G206800.1 "H"    "E"    "P"    "L"    "D"    "S"    "G"    "F"
## Glyma.18G030200.1 "D"    "L"    "P"    "L"    "D"    "N"    "G"    "V"
##                   [,422] [,423] [,424] [,425] [,426] [,427] [,428] [,429]
## Glyma.16G050500.1 "G"    "A"    "I"    "V"    "Q"    "S"    "C"    "R"
## Glyma.16G146400.1 "G"    "A"    "I"    "V"    "Q"    "S"    "C"    "K"
## Glyma.04G093500.1 "G"    "A"    "I"    "V"    "M"    "N"    "C"    "K"
## Glyma.02G065300.1 "G"    "A"    "I"    "V"    "Q"    "S"    "C"    "K"
## Glyma.02G211800.1 "G"    "A"    "I"    "V"    "M"    "N"    "C"    "K"
## Glyma.02G254300.1 "R"    "A"    "L"    "L"    "R"    "G"    "C"    "D"
## Glyma.02G152800.2 "G"    "A"    "I"    "V"    "E"    "H"    "C"    "K"
## Glyma.10G021500.2 "G"    "A"    "I"    "V"    "E"    "H"    "C"    "K"
## Glyma.08G059500.6 "G"    "A"    "V"    "V"    "K"    "T"    "C"    "T"
## Glyma.07G189800.5 "G"    "A"    "V"    "V"    "K"    "T"    "C"    "T"
## Glyma.11G227300.1 "R"    "A"    "L"    "L"    "R"    "G"    "C"    "N"
## Glyma.14G179500.1 "G"    "A"    "I"    "V"    "M"    "N"    "C"    "K"
## Glyma.14G062100.1 "R"    "A"    "L"    "L"    "R"    "G"    "C"    "D"
## Glyma.06G095400.1 "G"    "A"    "I"    "V"    "M"    "N"    "C"    "K"
## Glyma.03G209400.1 "G"    "A"    "I"    "V"    "E"    "Q"    "C"    "K"
## Glyma.19G100200.1 "G"    "A"    "I"    "V"    "Q"    "S"    "C"    "R"
## Glyma.19G206800.1 "G"    "A"    "I"    "V"    "E"    "Q"    "C"    "K"
## Glyma.18G030200.1 "R"    "A"    "L"    "L"    "R"    "G"    "C"    "D"
##                   [,430] [,431] [,432] [,433] [,434] [,435] [,436] [,437]
## Glyma.16G050500.1 "R"    "L"    "R"    "R"    "L"    "S"    "L"    "S"
## Glyma.16G146400.1 "Q"    "L"    "R"    "R"    "L"    "S"    "L"    "S"
## Glyma.04G093500.1 "K"    "L"    "T"    "R"    "L"    "A"    "V"    "S"
## Glyma.02G065300.1 "Q"    "L"    "R"    "R"    "L"    "S"    "L"    "S"
## Glyma.02G211800.1 "K"    "L"    "T"    "R"    "L"    "A"    "V"    "S"
## Glyma.02G254300.1 "K"    "L"    "R"    "R"    "F"    "A"    "L"    "P"
## Glyma.02G152800.2 "D"    "L"    "Q"    "R"    "L"    "S"    "L"    "S"
## Glyma.10G021500.2 "D"    "L"    "Q"    "R"    "L"    "S"    "L"    "S"
## Glyma.08G059500.6 "K"    "L"    "Q"    "R"    "L"    "A"    "V"    "S"
## Glyma.07G189800.5 "K"    "L"    "Q"    "R"    "L"    "A"    "V"    "S"
```

```
## Glyma.11G227300.1 "K"    "L"    "R"    "R"    "F"    "A"    "L"    "R"
## Glyma.14G179500.1 "K"    "L"    "T"    "R"    "L"    "A"    "M"    "S"
## Glyma.14G062100.1 "K"    "L"    "R"    "R"    "F"    "A"    "L"    "P"
## Glyma.06G095400.1 "K"    "L"    "T"    "R"    "L"    "A"    "V"    "S"
## Glyma.03G209400.1 "D"    "L"    "Q"    "R"    "L"    "S"    "L"    "S"
## Glyma.19G100200.1 "R"    "L"    "R"    "R"    "L"    "S"    "L"    "S"
## Glyma.19G206800.1 "D"    "L"    "Q"    "R"    "L"    "S"    "L"    "S"
## Glyma.18G030200.1 "K"    "L"    "R"    "R"    "F"    "A"    "L"    "R"
##                   [,438] [,439] [,440] [,441] [,442] [,443] [,444] [,445]
## Glyma.16G050500.1 "G"    "Q"    "L"    "T"    "D"    "Q"    "V"    "F"
## Glyma.16G146400.1 "G"    "Q"    "L"    "T"    "D"    "Q"    "V"    "F"
## Glyma.04G093500.1 "G"    "L"    "L"    "T"    "D"    "R"    "A"    "F"
## Glyma.02G065300.1 "G"    "Q"    "L"    "T"    "D"    "Q"    "V"    "F"
## Glyma.02G211800.1 "G"    "L"    "L"    "T"    "D"    "R"    "A"    "F"
## Glyma.02G254300.1 "G"    "G"    "L"    "T"    "D"    "V"    "G"    "L"
## Glyma.02G152800.2 "G"    "L"    "L"    "T"    "D"    "R"    "V"    "F"
## Glyma.10G021500.2 "G"    "L"    "L"    "T"    "D"    "R"    "V"    "F"
## Glyma.08G059500.6 "G"    "Y"    "L"    "T"    "D"    "L"    "T"    "F"
## Glyma.07G189800.5 "G"    "Y"    "L"    "T"    "D"    "L"    "T"    "F"
## Glyma.11G227300.1 "G"    "G"    "L"    "T"    "D"    "V"    "G"    "L"
## Glyma.14G179500.1 "G"    "L"    "L"    "T"    "D"    "R"    "V"    "F"
## Glyma.14G062100.1 "G"    "G"    "L"    "T"    "D"    "V"    "G"    "L"
## Glyma.06G095400.1 "G"    "L"    "L"    "T"    "D"    "R"    "A"    "F"
## Glyma.03G209400.1 "G"    "L"    "L"    "T"    "D"    "R"    "V"    "F"
## Glyma.19G100200.1 "G"    "K"    "L"    "T"    "D"    "Q"    "V"    "F"
## Glyma.19G206800.1 "G"    "L"    "L"    "T"    "D"    "R"    "V"    "F"
## Glyma.18G030200.1 "G"    "G"    "L"    "T"    "D"    "V"    "G"    "L"
##                   [,446] [,447] [,448] [,449] [,450] [,451] [,452] [,453]
## Glyma.16G050500.1 "L"    "Y"    "I"    "G"    "M"    "Y"    "A"    "E"
## Glyma.16G146400.1 "L"    "Y"    "I"    "G"    "M"    "Y"    "A"    "E"
## Glyma.04G093500.1 "N"    "Y"    "I"    "G"    "T"    "Y"    "G"    "K"
## Glyma.02G065300.1 "L"    "Y"    "I"    "G"    "V"    "Y"    "A"    "E"
## Glyma.02G211800.1 "E"    "Y"    "I"    "G"    "T"    "Y"    "G"    "K"
## Glyma.02G254300.1 "G"    "Y"    "V"    "G"    "Q"    "Y"    "S"    "P"
## Glyma.02G152800.2 "E"    "Y"    "I"    "G"    "T"    "Y"    "G"    "K"
## Glyma.10G021500.2 "E"    "Y"    "I"    "G"    "T"    "Y"    "G"    "K"
## Glyma.08G059500.6 "E"    "Y"    "I"    "G"    "K"    "Y"    "A"    "K"
## Glyma.07G189800.5 "E"    "Y"    "I"    "G"    "K"    "Y"    "A"    "K"
## Glyma.11G227300.1 "G"    "Y"    "I"    "G"    "Q"    "Y"    "S"    "P"
## Glyma.14G179500.1 "E"    "Y"    "I"    "G"    "M"    "Y"    "G"    "K"
## Glyma.14G062100.1 "G"    "Y"    "I"    "G"    "Q"    "Y"    "S"    "P"
## Glyma.06G095400.1 "S"    "Y"    "I"    "G"    "T"    "Y"    "G"    "K"
## Glyma.03G209400.1 "E"    "Y"    "I"    "G"    "T"    "Y"    "A"    "K"
## Glyma.19G100200.1 "L"    "Y"    "I"    "G"    "M"    "Y"    "A"    "E"
## Glyma.19G206800.1 "E"    "Y"    "I"    "G"    "T"    "C"    "G"    "K"
## Glyma.18G030200.1 "G"    "Y"    "I"    "G"    "Q"    "Y"    "S"    "P"
##                   [,454] [,455] [,456] [,457] [,458] [,459] [,460] [,461]
## Glyma.16G050500.1 "K"    "L"    "E"    "M"    "L"    "S"    "I"    "A"
## Glyma.16G146400.1 "Q"    "L"    "E"    "M"    "L"    "S"    "V"    "A"
## Glyma.04G093500.1 "L"    "I"    "R"    "T"    "L"    "S"    "V"    "A"
## Glyma.02G065300.1 "Q"    "L"    "E"    "M"    "L"    "S"    "I"    "A"
## Glyma.02G211800.1 "L"    "V"    "R"    "T"    "L"    "S"    "V"    "A"
## Glyma.02G254300.1 "N"    "V"    "R"    "W"    "M"    "L"    "L"    "G"
## Glyma.02G152800.2 "K"    "L"    "E"    "M"    "L"    "S"    "V"    "A"
```

```
## Glyma.10G021500.2 "K"    "L"    "E"    "M"    "L"    "S"    "V"    "A"
## Glyma.08G059500.6 "N"    "L"    "E"    "T"    "L"    "S"    "V"    "A"
## Glyma.07G189800.5 "N"    "L"    "E"    "T"    "L"    "S"    "V"    "A"
## Glyma.11G227300.1 "N"    "V"    "R"    "W"    "M"    "L"    "L"    "G"
## Glyma.14G179500.1 "L"    "V"    "R"    "T"    "L"    "S"    "V"    "A"
## Glyma.14G062100.1 "N"    "V"    "R"    "W"    "M"    "L"    "L"    "G"
## Glyma.06G095400.1 "L"    "I"    "R"    "T"    "L"    "S"    "V"    "A"
## Glyma.03G209400.1 "K"    "L"    "E"    "M"    "L"    "S"    "V"    "A"
## Glyma.19G100200.1 "K"    "L"    "E"    "M"    "L"    "S"    "I"    "A"
## Glyma.19G206800.1 "K"    "L"    "E"    "M"    "L"    "S"    "V"    "A"
## Glyma.18G030200.1 "N"    "V"    "R"    "W"    "M"    "L"    "L"    "G"
##                   [,462] [,463] [,464] [,465] [,466] [,467] [,468] [,469]
## Glyma.16G050500.1 "F"    "A"    "G"    "E"    "S"    "D"    "K"    "G"
## Glyma.16G146400.1 "F"    "A"    "G"    "E"    "S"    "D"    "K"    "A"
## Glyma.04G093500.1 "F"    "A"    "G"    "D"    "T"    "D"    "L"    "G"
## Glyma.02G065300.1 "F"    "A"    "G"    "E"    "S"    "D"    "K"    "A"
## Glyma.02G211800.1 "F"    "A"    "G"    "D"    "T"    "D"    "V"    "G"
## Glyma.02G254300.1 "Y"    "V"    "G"    "E"    "T"    "D"    "A"    "G"
## Glyma.02G152800.2 "F"    "A"    "G"    "D"    "S"    "D"    "L"    "G"
## Glyma.10G021500.2 "F"    "A"    "G"    "D"    "S"    "D"    "L"    "G"
## Glyma.08G059500.6 "F"    "A"    "G"    "S"    "S"    "D"    "W"    "G"
## Glyma.07G189800.5 "F"    "A"    "G"    "S"    "S"    "D"    "W"    "G"
## Glyma.11G227300.1 "Y"    "V"    "G"    "E"    "S"    "D"    "A"    "G"
## Glyma.14G179500.1 "F"    "A"    "G"    "D"    "T"    "D"    "V"    "G"
## Glyma.14G062100.1 "Y"    "V"    "G"    "E"    "T"    "D"    "A"    "G"
## Glyma.06G095400.1 "F"    "A"    "G"    "D"    "T"    "D"    "L"    "G"
## Glyma.03G209400.1 "F"    "A"    "G"    "D"    "S"    "D"    "L"    "G"
## Glyma.19G100200.1 "F"    "A"    "G"    "D"    "G"    "D"    "K"    "G"
## Glyma.19G206800.1 "F"    "A"    "G"    "D"    "S"    "D"    "L"    "G"
## Glyma.18G030200.1 "Y"    "V"    "G"    "E"    "S"    "D"    "A"    "G"
##                   [,470] [,471] [,472] [,473] [,474] [,475] [,476] [,477]
## Glyma.16G050500.1 "M"    "L"    "Y"    "V"    "L"    "N"    "G"    "C"
## Glyma.16G146400.1 "M"    "L"    "Y"    "V"    "L"    "N"    "G"    "C"
## Glyma.04G093500.1 "L"    "Q"    "Y"    "V"    "L"    "E"    "G"    "C"
## Glyma.02G065300.1 "M"    "L"    "Y"    "V"    "L"    "N"    "G"    "C"
## Glyma.02G211800.1 "L"    "K"    "Y"    "V"    "L"    "K"    "G"    "C"
## Glyma.02G254300.1 "L"    "L"    "E"    "F"    "S"    "K"    "G"    "C"
## Glyma.02G152800.2 "L"    "H"    "H"    "V"    "L"    "S"    "G"    "C"
## Glyma.10G021500.2 "L"    "H"    "H"    "V"    "L"    "S"    "G"    "C"
## Glyma.08G059500.6 "M"    "R"    "C"    "V"    "L"    "D"    "G"    "C"
## Glyma.07G189800.5 "M"    "R"    "C"    "V"    "L"    "D"    "G"    "C"
## Glyma.11G227300.1 "L"    "L"    "E"    "F"    "S"    "K"    "G"    "C"
## Glyma.14G179500.1 "L"    "K"    "Y"    "V"    "L"    "E"    "G"    "C"
## Glyma.14G062100.1 "L"    "L"    "E"    "F"    "S"    "K"    "G"    "C"
## Glyma.06G095400.1 "L"    "Q"    "Y"    "V"    "L"    "Q"    "G"    "C"
## Glyma.03G209400.1 "L"    "H"    "H"    "V"    "L"    "S"    "G"    "C"
## Glyma.19G100200.1 "M"    "L"    "Y"    "V"    "L"    "N"    "G"    "C"
## Glyma.19G206800.1 "L"    "H"    "H"    "V"    "L"    "S"    "G"    "C"
## Glyma.18G030200.1 "L"    "L"    "E"    "F"    "A"    "K"    "G"    "C"
##                   [,478] [,479] [,480] [,481] [,482] [,483] [,484] [,485]
## Glyma.16G050500.1 "K"    "K"    "L"    "R"    "K"    "L"    "E"    "I"
## Glyma.16G146400.1 "K"    "K"    "I"    "H"    "K"    "L"    "A"    "I"
## Glyma.04G093500.1 "P"    "N"    "L"    "Q"    "K"    "L"    "E"    "I"
## Glyma.02G065300.1 "K"    "K"    "L"    "R"    "K"    "L"    "E"    "I"
```

```
## Glyma.02G211800.1 "P"    "N"    "L"    "Q"    "K"    "L"    "E"    "I"
## Glyma.02G254300.1 "P"    "S"    "L"    "Q"    "K"    "L"    "E"    "M"
## Glyma.02G152800.2 "D"    "N"    "L"    "R"    "K"    "L"    "E"    "I"
## Glyma.10G021500.2 "D"    "N"    "L"    "R"    "K"    "L"    "E"    "I"
## Glyma.08G059500.6 "P"    "K"    "L"    "R"    "K"    "L"    "E"    "V"
## Glyma.07G189800.5 "P"    "K"    "L"    "R"    "K"    "L"    "E"    "V"
## Glyma.11G227300.1 "P"    "S"    "L"    "Q"    "K"    "L"    "E"    "M"
## Glyma.14G179500.1 "P"    "N"    "L"    "Q"    "K"    "L"    "E"    "I"
## Glyma.14G062100.1 "P"    "S"    "L"    "Q"    "K"    "L"    "E"    "M"
## Glyma.06G095400.1 "P"    "N"    "L"    "Q"    "K"    "L"    "E"    "I"
## Glyma.03G209400.1 "D"    "N"    "L"    "R"    "K"    "L"    "E"    "I"
## Glyma.19G100200.1 "K"    "K"    "L"    "R"    "K"    "L"    "E"    "I"
## Glyma.19G206800.1 "D"    "N"    "L"    "R"    "K"    "L"    "E"    "I"
## Glyma.18G030200.1 "P"    "S"    "L"    "Q"    "K"    "L"    "E"    "M"
##                   [,486] [,487] [,488] [,489] [,490] [,491] [,492] [,493]
## Glyma.16G050500.1 "R"    "D"    "C"    "P"    "F"    "G"    "N"    "V"
## Glyma.16G146400.1 "R"    "G"    "S"    "P"    "F"    "G"    "D"    "S"
## Glyma.04G093500.1 "R"    "D"    "S"    "P"    "F"    "G"    "D"    "G"
## Glyma.02G065300.1 "R"    "D"    "S"    "P"    "F"    "G"    "D"    "S"
## Glyma.02G211800.1 "R"    "D"    "S"    "P"    "F"    "G"    "D"    "G"
## Glyma.02G254300.1 "R"    "G"    "C"    "S"    "F"    "S"    "E"    "Y"
## Glyma.02G152800.2 "R"    "D"    "C"    "P"    "F"    "G"    "D"    "K"
## Glyma.10G021500.2 "R"    "D"    "C"    "P"    "F"    "G"    "D"    "K"
## Glyma.08G059500.6 "R"    "D"    "C"    "P"    "F"    "G"    "N"    "G"
## Glyma.07G189800.5 "R"    "D"    "C"    "P"    "F"    "G"    "N"    "G"
## Glyma.11G227300.1 "R"    "G"    "C"    "S"    "F"    "S"    "E"    "R"
## Glyma.14G179500.1 "R"    "D"    "S"    "P"    "F"    "G"    "D"    "G"
## Glyma.14G062100.1 "R"    "G"    "C"    "S"    "F"    "S"    "E"    "Y"
## Glyma.06G095400.1 "R"    "D"    "S"    "P"    "F"    "G"    "D"    "G"
## Glyma.03G209400.1 "R"    "D"    "C"    "P"    "F"    "G"    "D"    "K"
## Glyma.19G100200.1 "R"    "D"    "C"    "P"    "F"    "G"    "D"    "M"
## Glyma.19G206800.1 "R"    "D"    "C"    "P"    "F"    "G"    "D"    "K"
## Glyma.18G030200.1 "R"    "G"    "C"    "L"    "F"    "S"    "E"    "R"
##                   [,494] [,495] [,496] [,497] [,498] [,499] [,500] [,501]
## Glyma.16G050500.1 "A"    "L"    "L"    "T"    "D"    "V"    "G"    "K"
## Glyma.16G146400.1 "A"    "L"    "L"    "M"    "D"    "V"    "G"    "K"
## Glyma.04G093500.1 "A"    "L"    "R"    "S"    "G"    "L"    "H"    "H"
## Glyma.02G065300.1 "A"    "L"    "L"    "M"    "D"    "V"    "G"    "K"
## Glyma.02G211800.1 "A"    "L"    "R"    "S"    "G"    "L"    "H"    "H"
## Glyma.02G254300.1 "A"    "L"    "A"    "I"    "A"    "A"    "T"    "Q"
## Glyma.02G152800.2 "A"    "L"    "L"    "A"    "N"    "A"    "A"    "K"
## Glyma.10G021500.2 "A"    "L"    "L"    "A"    "N"    "A"    "A"    "K"
## Glyma.08G059500.6 "A"    "L"    "L"    "S"    "G"    "L"    "G"    "K"
## Glyma.07G189800.5 "A"    "L"    "L"    "S"    "G"    "L"    "G"    "K"
## Glyma.11G227300.1 "A"    "L"    "A"    "V"    "A"    "A"    "T"    "Q"
## Glyma.14G179500.1 "A"    "L"    "R"    "S"    "G"    "L"    "H"    "H"
## Glyma.14G062100.1 "A"    "L"    "A"    "I"    "A"    "A"    "T"    "Q"
## Glyma.06G095400.1 "A"    "L"    "H"    "S"    "G"    "L"    "H"    "H"
## Glyma.03G209400.1 "A"    "L"    "L"    "A"    "N"    "A"    "E"    "K"
## Glyma.19G100200.1 "A"    "L"    "L"    "T"    "D"    "V"    "G"    "K"
## Glyma.19G206800.1 "A"    "L"    "L"    "A"    "N"    "A"    "E"    "K"
## Glyma.18G030200.1 "A"    "L"    "A"    "V"    "A"    "A"    "T"    "Q"
##                   [,502] [,503] [,504] [,505] [,506] [,507] [,508] [,509]
## Glyma.16G050500.1 "Y"    "E"    "T"    "M"    "R"    "S"    "L"    "W"
```

```
## Glyma.16G146400.1 "Y"    "E"    "T"    "M"    "Q"    "F"    "L"    "W"
## Glyma.04G093500.1 "F"    "Y"    "N"    "M"    "R"    "F"    "L"    "W"
## Glyma.02G065300.1 "Y"    "E"    "T"    "M"    "R"    "S"    "L"    "W"
## Glyma.02G211800.1 "Y"    "Y"    "N"    "M"    "R"    "F"    "L"    "W"
## Glyma.02G254300.1 "L"    "N"    "S"    "L"    "R"    "Y"    "L"    "W"
## Glyma.02G152800.2 "L"    "E"    "T"    "M"    "R"    "S"    "L"    "W"
## Glyma.10G021500.2 "L"    "E"    "T"    "M"    "R"    "S"    "L"    "W"
## Glyma.08G059500.6 "Y"    "E"    "S"    "M"    "R"    "S"    "L"    "W"
## Glyma.07G189800.5 "Y"    "E"    "S"    "M"    "R"    "S"    "L"    "W"
## Glyma.11G227300.1 "L"    "T"    "S"    "L"    "R"    "Y"    "L"    "W"
## Glyma.14G179500.1 "Y"    "Y"    "N"    "M"    "R"    "F"    "L"    "W"
## Glyma.14G062100.1 "L"    "N"    "S"    "L"    "R"    "Y"    "L"    "W"
## Glyma.06G095400.1 "F"    "Y"    "N"    "M"    "R"    "F"    "L"    "W"
## Glyma.03G209400.1 "L"    "E"    "T"    "M"    "R"    "S"    "L"    "W"
## Glyma.19G100200.1 "Y"    "E"    "T"    "M"    "R"    "S"    "L"    "W"
## Glyma.19G206800.1 "L"    "E"    "T"    "M"    "R"    "S"    "L"    "W"
## Glyma.18G030200.1 "L"    "T"    "S"    "L"    "R"    "Y"    "L"    "W"
##                   [,510] [,511] [,512] [,513] [,514] [,515] [,516] [,517]
## Glyma.16G050500.1 "M"    "S"    "S"    "C"    "E"    "V"    "T"    "V"
## Glyma.16G146400.1 "M"    "T"    "S"    "C"    "N"    "V"    "T"    "V"
## Glyma.04G093500.1 "M"    "S"    "S"    "C"    "K"    "L"    "T"    "R"
## Glyma.02G065300.1 "M"    "S"    "S"    "C"    "D"    "V"    "T"    "I"
## Glyma.02G211800.1 "M"    "S"    "T"    "C"    "K"    "L"    "T"    "L"
## Glyma.02G254300.1 "V"    "Q"    "G"    "Y"    "S"    "A"    "S"    "A"
## Glyma.02G152800.2 "M"    "S"    "S"    "C"    "L"    "V"    "S"    "Y"
## Glyma.10G021500.2 "M"    "S"    "S"    "C"    "L"    "V"    "S"    "Y"
## Glyma.08G059500.6 "M"    "S"    "D"    "C"    "N"    "L"    "T"    "M"
## Glyma.07G189800.5 "M"    "S"    "D"    "C"    "N"    "L"    "T"    "M"
## Glyma.11G227300.1 "V"    "Q"    "G"    "Y"    "G"    "V"    "S"    "P"
## Glyma.14G179500.1 "M"    "S"    "S"    "C"    "K"    "L"    "T"    "R"
## Glyma.14G062100.1 "V"    "Q"    "G"    "Y"    "G"    "A"    "S"    "P"
## Glyma.06G095400.1 "M"    "S"    "S"    "C"    "K"    "L"    "T"    "R"
## Glyma.03G209400.1 "M"    "S"    "S"    "C"    "S"    "V"    "S"    "Y"
## Glyma.19G100200.1 "M"    "S"    "S"    "C"    "E"    "V"    "T"    "V"
## Glyma.19G206800.1 "M"    "S"    "S"    "C"    "S"    "V"    "S"    "Y"
## Glyma.18G030200.1 "V"    "Q"    "G"    "Y"    "G"    "V"    "S"    "P"
##                   [,518] [,519] [,520] [,521] [,522] [,523] [,524] [,525]
## Glyma.16G050500.1 "G"    "A"    "C"    "K"    "L"    "L"    "A"    "K"
## Glyma.16G146400.1 "G"    "A"    "C"    "K"    "A"    "L"    "A"    "E"
## Glyma.04G093500.1 "Q"    "A"    "C"    "R"    "E"    "V"    "A"    "R"
## Glyma.02G065300.1 "G"    "A"    "C"    "K"    "A"    "L"    "A"    "K"
## Glyma.02G211800.1 "Q"    "A"    "C"    "Q"    "E"    "V"    "A"    "R"
## Glyma.02G254300.1 "S"    "G"    "R"    "D"    "L"    "L"    "A"    "M"
## Glyma.02G152800.2 "G"    "A"    "C"    "K"    "L"    "L"    "G"    "Q"
## Glyma.10G021500.2 "G"    "A"    "C"    "K"    "L"    "L"    "G"    "Q"
## Glyma.08G059500.6 "N"    "G"    "V"    "R"    "L"    "L"    "A"    "K"
## Glyma.07G189800.5 "N"    "G"    "V"    "R"    "L"    "L"    "A"    "Q"
## Glyma.11G227300.1 "S"    "G"    "R"    "D"    "L"    "L"    "A"    "M"
## Glyma.14G179500.1 "Q"    "A"    "C"    "Q"    "E"    "V"    "A"    "R"
## Glyma.14G062100.1 "S"    "G"    "R"    "D"    "L"    "L"    "A"    "M"
## Glyma.06G095400.1 "Q"    "A"    "C"    "Q"    "E"    "V"    "A"    "Q"
## Glyma.03G209400.1 "G"    "A"    "C"    "K"    "L"    "L"    "G"    "Q"
## Glyma.19G100200.1 "G"    "A"    "C"    "K"    "L"    "L"    "A"    "K"
## Glyma.19G206800.1 "G"    "A"    "C"    "K"    "L"    "L"    "G"    "Q"
```

```
## Glyma.18G030200.1 "S"    "G"    "R"    "D"    "L"    "L"    "V"    "M"
##                   [,526] [,527] [,528] [,529] [,530] [,531] [,532] [,533]
## Glyma.16G050500.1 "K"    "M"    "P"    "R"    "L"    "N"    "V"    "E"
## Glyma.16G146400.1 "K"    "M"    "P"    "R"    "L"    "N"    "V"    "E"
## Glyma.04G093500.1 "M"    "L"    "P"    "H"    "L"    "V"    "L"    "E"
## Glyma.02G065300.1 "K"    "M"    "P"    "G"    "L"    "N"    "V"    "E"
## Glyma.02G211800.1 "V"    "L"    "P"    "N"    "L"    "V"    "F"    "E"
## Glyma.02G254300.1 "A"    "R"    "P"    "Y"    "W"    "N"    "I"    "E"
## Glyma.02G152800.2 "K"    "M"    "P"    "R"    "L"    "N"    "V"    "E"
## Glyma.10G021500.2 "K"    "L"    "P"    "R"    "L"    "N"    "V"    "E"
## Glyma.08G059500.6 "E"    "M"    "P"    "R"    "L"    "N"    "V"    "E"
## Glyma.07G189800.5 "E"    "M"    "P"    "R"    "L"    "N"    "V"    "E"
## Glyma.11G227300.1 "A"    "R"    "P"    "F"    "W"    "N"    "I"    "E"
## Glyma.14G179500.1 "A"    "L"    "P"    "N"    "L"    "V"    "L"    "E"
## Glyma.14G062100.1 "A"    "R"    "P"    "Y"    "W"    "N"    "I"    "E"
## Glyma.06G095400.1 "T"    "L"    "P"    "H"    "L"    "V"    "L"    "E"
## Glyma.03G209400.1 "K"    "M"    "P"    "R"    "L"    "N"    "V"    "E"
## Glyma.19G100200.1 "K"    "M"    "P"    "R"    "L"    "N"    "V"    "E"
## Glyma.19G206800.1 "K"    "M"    "P"    "R"    "L"    "N"    "V"    "E"
## Glyma.18G030200.1 "A"    "R"    "P"    "F"    "W"    "N"    "I"    "E"
##                   [,534] [,535] [,536] [,537] [,538] [,539] [,540] [,541]
## Glyma.16G050500.1 "I"    "F"    "N"    "E"    "N"    "E"    "Q"    "E"
## Glyma.16G146400.1 "I"    "F"    "N"    "E"    "N"    "K"    "K"    "V"
## Glyma.04G093500.1 "V"    "I"    "N"    "-"    "-"    "S"    "E"    "E"
## Glyma.02G065300.1 "I"    "F"    "N"    "G"    "N"    "E"    "K"    "V"
## Glyma.02G211800.1 "V"    "I"    "N"    "N"    "N"    "S"    "E"    "E"
## Glyma.02G254300.1 "L"    "I"    "P"    "S"    "R"    "S"    "V"    "V"
## Glyma.02G152800.2 "V"    "I"    "D"    "E"    "R"    "G"    "P"    "P"
## Glyma.10G021500.2 "V"    "I"    "D"    "E"    "R"    "G"    "P"    "P"
## Glyma.08G059500.6 "V"    "I"    "K"    "E"    "E"    "T"    "Y"    "E"
## Glyma.07G189800.5 "V"    "I"    "K"    "E"    "E"    "S"    "Y"    "E"
## Glyma.11G227300.1 "L"    "I"    "P"    "S"    "R"    "K"    "V"    "A"
## Glyma.14G179500.1 "V"    "I"    "N"    "N"    "N"    "N"    "E"    "E"
## Glyma.14G062100.1 "L"    "I"    "P"    "S"    "R"    "R"    "V"    "V"
## Glyma.06G095400.1 "V"    "I"    "N"    "-"    "-"    "S"    "E"    "E"
## Glyma.03G209400.1 "V"    "I"    "D"    "E"    "R"    "G"    "P"    "P"
## Glyma.19G100200.1 "I"    "F"    "N"    "E"    "N"    "E"    "Q"    "E"
## Glyma.19G206800.1 "V"    "I"    "D"    "E"    "R"    "G"    "P"    "P"
## Glyma.18G030200.1 "L"    "I"    "P"    "S"    "R"    "K"    "V"    "A"
##                   [,542] [,543] [,544] [,545] [,546] [,547] [,548] [,549]
## Glyma.16G050500.1 "D"    "C"    "S"    "Q"    "K"    "V"    "E"    "K"
## Glyma.16G146400.1 "D"    "R"    "D"    "Q"    "K"    "V"    "E"    "K"
## Glyma.04G093500.1 "D"    "K"    "A"    "D"    "D"    "I"    "E"    "I"
## Glyma.02G065300.1 "D"    "R"    "D"    "Q"    "K"    "V"    "E"    "K"
## Glyma.02G211800.1 "N"    "A"    "G"    "D"    "E"    "V"    "E"    "T"
## Glyma.02G254300.1 "V"    "S"    "N"    "E"    "H"    "L"    "A"    "H"
## Glyma.02G152800.2 "D"    "S"    "R"    "S"    "P"    "V"    "E"    "K"
## Glyma.10G021500.2 "D"    "S"    "R"    "S"    "P"    "V"    "E"    "K"
## Glyma.08G059500.6 "T"    "-"    "-"    "H"    "Q"    "A"    "K"    "K"
## Glyma.07G189800.5 "T"    "-"    "-"    "H"    "Q"    "A"    "K"    "K"
## Glyma.11G227300.1 "M"    "N"    "T"    "E"    "H"    "P"    "A"    "H"
## Glyma.14G179500.1 "N"    "A"    "G"    "D"    "E"    "V"    "E"    "T"
## Glyma.14G062100.1 "V"    "S"    "N"    "E"    "H"    "P"    "A"    "H"
## Glyma.06G095400.1 "D"    "K"    "A"    "D"    "G"    "I"    "E"    "I"
```

```
## Glyma.03G209400.1 "D"    "S"    "R"    "C"    "P"    "V"    "E"    "K"
## Glyma.19G100200.1 "D"    "C"    "S"    "Q"    "K"    "V"    "E"    "K"
## Glyma.19G206800.1 "D"    "S"    "R"    "C"    "P"    "V"    "E"    "K"
## Glyma.18G030200.1 "T"    "N"    "T"    "E"    "H"    "P"    "A"    "H"
##                   [,550] [,551] [,552] [,553] [,554] [,555] [,556] [,557]
## Glyma.16G050500.1 "M"    "Y"    "L"    "Y"    "R"    "T"    "L"    "A"
## Glyma.16G146400.1 "M"    "Y"    "L"    "Y"    "R"    "T"    "L"    "A"
## Glyma.04G093500.1 "L"    "Y"    "M"    "Y"    "R"    "S"    "L"    "D"
## Glyma.02G065300.1 "T"    "Y"    "L"    "Y"    "R"    "T"    "L"    "V"
## Glyma.02G211800.1 "L"    "Y"    "M"    "Y"    "R"    "S"    "L"    "D"
## Glyma.02G254300.1 "I"    "L"    "A"    "Y"    "Y"    "S"    "L"    "A"
## Glyma.02G152800.2 "L"    "Y"    "I"    "Y"    "R"    "T"    "V"    "S"
## Glyma.10G021500.2 "L"    "Y"    "M"    "Y"    "R"    "T"    "V"    "S"
## Glyma.08G059500.6 "V"    "Y"    "V"    "Y"    "R"    "S"    "V"    "A"
## Glyma.07G189800.5 "V"    "Y"    "V"    "Y"    "R"    "S"    "V"    "A"
## Glyma.11G227300.1 "I"    "L"    "A"    "Y"    "Y"    "S"    "L"    "A"
## Glyma.14G179500.1 "L"    "Y"    "M"    "Y"    "R"    "S"    "L"    "D"
## Glyma.14G062100.1 "I"    "L"    "A"    "Y"    "Y"    "S"    "L"    "A"
## Glyma.06G095400.1 "L"    "Y"    "M"    "Y"    "R"    "S"    "L"    "D"
## Glyma.03G209400.1 "L"    "Y"    "I"    "Y"    "R"    "T"    "V"    "A"
## Glyma.19G100200.1 "M"    "Y"    "L"    "Y"    "R"    "T"    "L"    "A"
## Glyma.19G206800.1 "L"    "Y"    "I"    "Y"    "R"    "T"    "I"    "A"
## Glyma.18G030200.1 "I"    "L"    "A"    "Y"    "Y"    "S"    "L"    "A"
##                   [,558] [,559] [,560] [,561] [,562] [,563] [,564] [,565]
## Glyma.16G050500.1 "G"    "K"    "R"    "K"    "D"    "A"    "P"    "E"
## Glyma.16G146400.1 "G"    "R"    "R"    "K"    "D"    "A"    "P"    "E"
## Glyma.04G093500.1 "R"    "P"    "R"    "D"    "D"    "A"    "P"    "K"
## Glyma.02G065300.1 "G"    "R"    "R"    "K"    "D"    "A"    "P"    "E"
## Glyma.02G211800.1 "G"    "P"    "R"    "D"    "D"    "A"    "P"    "R"
## Glyma.02G254300.1 "G"    "P"    "R"    "T"    "D"    "F"    "P"    "D"
## Glyma.02G152800.2 "G"    "P"    "R"    "L"    "D"    "M"    "P"    "G"
## Glyma.10G021500.2 "G"    "P"    "R"    "L"    "D"    "M"    "P"    "G"
## Glyma.08G059500.6 "G"    "P"    "R"    "R"    "D"    "A"    "P"    "P"
## Glyma.07G189800.5 "G"    "P"    "R"    "R"    "D"    "A"    "P"    "P"
## Glyma.11G227300.1 "G"    "Q"    "R"    "S"    "D"    "F"    "P"    "D"
## Glyma.14G179500.1 "G"    "P"    "R"    "D"    "D"    "A"    "P"    "R"
## Glyma.14G062100.1 "G"    "P"    "R"    "T"    "D"    "F"    "P"    "D"
## Glyma.06G095400.1 "G"    "P"    "R"    "D"    "D"    "A"    "P"    "K"
## Glyma.03G209400.1 "G"    "P"    "R"    "L"    "D"    "M"    "P"    "G"
## Glyma.19G100200.1 "G"    "K"    "R"    "K"    "D"    "A"    "P"    "E"
## Glyma.19G206800.1 "G"    "P"    "R"    "L"    "D"    "M"    "P"    "G"
## Glyma.18G030200.1 "G"    "Q"    "R"    "S"    "D"    "F"    "P"    "D"
##                   [,566] [,567] [,568] [,569] [,570] [,571]
## Glyma.16G050500.1 "Y"    "V"    "W"    "T"    "L"    "*"
## Glyma.16G146400.1 "L"    "V"    "W"    "T"    "L"    "*"
## Glyma.04G093500.1 "V"    "V"    "T"    "I"    "L"    "*"
## Glyma.02G065300.1 "H"    "V"    "W"    "T"    "L"    "*"
## Glyma.02G211800.1 "F"    "V"    "T"    "I"    "L"    "*"
## Glyma.02G254300.1 "T"    "V"    "I"    "P"    "L"    "*"
## Glyma.02G152800.2 "Y"    "V"    "W"    "R"    "M"    "*"
## Glyma.10G021500.2 "Y"    "V"    "W"    "R"    "M"    "*"
## Glyma.08G059500.6 "F"    "V"    "L"    "T"    "L"    "*"
## Glyma.07G189800.5 "F"    "V"    "L"    "T"    "L"    "*"
## Glyma.11G227300.1 "T"    "V"    "V"    "P"    "L"    "*"
```

```
## Glyma.14G179500.1 "F"    "V"    "T"    "I"    "L"    "*"
## Glyma.14G062100.1 "T"    "V"    "I"    "P"    "L"    "*"
## Glyma.06G095400.1 "V"    "V"    "T"    "I"    "L"    "*"
## Glyma.03G209400.1 "F"    "V"    "W"    "T"    "M"    "*"
## Glyma.19G100200.1 "Y"    "V"    "W"    "T"    "L"    "*"
## Glyma.19G206800.1 "F"    "V"    "W"    "T"    "M"    "*"
## Glyma.18G030200.1 "T"    "V"    "V"    "P"    "L"    "*"
```

```
# Also remove all the * from sequences because MrBayes does not like it
matrix_AFB <-  sub("\\*", "-", matrix_AFB)

DECIPHER::BrowseSeqs(AAStringSet(matrix_AFB))

# Write nex file for MrBayes analysis
ape::write.nexus.data(matrix_AFB, format = "protein",
                      file = "AFB_input/AFB_final.nex",
                      datablock = TRUE,
                      interleaved = TRUE,
                      charsperline = NULL,
                      gap = NULL, missing = NULL)

# MBayes steps was the same as specified in the AFB_final.Rmd file. Outgroup was GLYMA_11G227300 (GmCOI
# mcmcp stopval=0.01 stoprule=yes Mcmcdiagn=yes nchains=4 printfreq=1000 samplefreq=100 burnin=200 relb
```

Build tree with multiple family

I will be adding L. japonicus, G. max, G. soja, A. thaliana, Medicago truncatula

```
Mult_AFB <- Biostrings::readAAStringSet(filepath = "AFB_input/AFB_multi.fasta")
Mult_AFB <- unique(Mult_AFB)
names(Mult_AFB)
```

```
##  [1] "Medtr3g070140|Medtr3g070140.1"
##  [2] "Medtr3g100860|Medtr3g100860.1"
##  [3] "Medtr8g098695|Medtr8g098695.2"
##  [4] "Medtr7g083610|Medtr7g083610.1"
##  [5] "Medtr5g065490|Medtr5g065490.1"
##  [6] "Medtr5g081870|Medtr5g081870.1"
##  [7] "Medtr1g088950|Medtr1g088950.1"
##  [8] "Medtr4g091290|Medtr4g091290.1"
##  [9] "AT2G39940|AT2G39940.1"
## [10] "AT4G03190|AT4G03190.1"
## [11] "AT4G24390|AT4G24390.1"
## [12] "AT1G12820|AT1G12820.1"
## [13] "AT3G26810|AT3G26810.1"
## [14] "AT3G62980|AT3G62980.1"
## [15] "AT5G49980|AT5G49980.1"
## [16] "Glyma.16G050500|Glyma.16G050500.1"
## [17] "Glyma.16G146400|Glyma.16G146400.1"
## [18] "Glyma.04G093500|Glyma.04G093500.1"
## [19] "Glyma.02G065300|Glyma.02G065300.1"
## [20] "Glyma.02G211800|Glyma.02G211800.1"
## [21] "Glyma.02G254300|Glyma.02G254300.1"
## [22] "Glyma.02G152800|Glyma.02G152800.2"
```

```
## [23] "Glyma.02G152800|Glyma.02G152800.3"
## [24] "Glyma.10G021500|Glyma.10G021500.2"
## [25] "Glyma.08G059500|Glyma.08G059500.6"
## [26] "Glyma.07G189800|Glyma.07G189800.5"
## [27] "Glyma.11G227300|Glyma.11G227300.1"
## [28] "Glyma.14G179500|Glyma.14G179500.1"
## [29] "Glyma.14G062100|Glyma.14G062100.1"
## [30] "Glyma.06G095400|Glyma.06G095400.1"
## [31] "Glyma.03G209400|Glyma.03G209400.1"
## [32] "Glyma.19G100200|Glyma.19G100200.1"
## [33] "Glyma.19G206800|Glyma.19G206800.1"
## [34] "Glyma.18G030200|Glyma.18G030200.1"
## [35] "GlysoPI483463.19G168300|GlysoPI483463.19G168300.1"
## [36] "GlysoPI483463.03G169700|GlysoPI483463.03G169700.1"
## [37] "GlysoPI483463.14G141800|GlysoPI483463.14G141800.1"
## [38] "GlysoPI483463.02G212600|GlysoPI483463.02G212600.1"
## [39] "GlysoPI483463.02G175100|GlysoPI483463.02G175100.1"
## [40] "Lj1g0006513|Lj1g0006513.1"
## [41] "Lj1g0027142|Lj1g0027142.1"
## [42] "Lj1g0015670|Lj1g0015670.1"
## [43] "Lj3g0010583|Lj3g0010583.1"
## [44] "Lj5g0004781|Lj5g0004781.1"
## [45] "LjContig00357g0020173|LjContig00357g0020173.1"
## [46] "Lj6g0020395|Lj6g0020395.1"
## [47] "Lj4g0012889|Lj4g0012889.1"
## [48] "LOC_Os04g32460|LOC_Os04g32460.1"
## [49] "LOC_Os01g63420|LOC_Os01g63420.1"
## [50] "LOC_Os01g63420|LOC_Os01g63420.2"
## [51] "LOC_Os01g63420|LOC_Os01g63420.3"
## [52] "LOC_Os03g08850|LOC_Os03g08850.1"
## [53] "LOC_Os03g15880|LOC_Os03g15880.4"
## [54] "LOC_Os02g52230|LOC_Os02g52230.1"
## [55] "LOC_Os05g37690|LOC_Os05g37690.1"
## [56] "LOC_Os05g05800|LOC_Os05g05800.1"
## [57] "LOC_Os11g31620|LOC_Os11g31620.1"
```

```
phylotools::rm.sequence.fasta(infile = "AFB_input/AFB_multi.fasta", to.rm =c("Glyma.02G152800|Glyma.02G
```

```
## Warning in readLines(file): incomplete final line found on
## 'AFB_input/AFB_multi.fasta'
```

```
## AFB_input/AFB_multi_removed.fasta has been saved to  /Users/deisianyneres/GitHub/SoyArcs_manuscript/
```

```
 Mult_AFB2 <- Biostrings::readAAStringSet(filepath = "AFB_input/AFB_multi_removed.fasta")
names(Mult_AFB2)
```

```
##  [1] "Medtr3g070140|Medtr3g070140.1"
##  [2] "Medtr3g100860|Medtr3g100860.1"
##  [3] "Medtr8g098695|Medtr8g098695.2"
##  [4] "Medtr7g083610|Medtr7g083610.1"
##  [5] "Medtr5g065490|Medtr5g065490.1"
##  [6] "Medtr5g081870|Medtr5g081870.1"
##  [7] "Medtr1g088950|Medtr1g088950.1"
##  [8] "Medtr4g091290|Medtr4g091290.1"
##  [9] "AT2G39940|AT2G39940.1"
## [10] "AT4G03190|AT4G03190.1"
```

```
## [11] "AT4G24390|AT4G24390.1"
## [12] "AT1G12820|AT1G12820.1"
## [13] "AT3G26810|AT3G26810.1"
## [14] "AT3G62980|AT3G62980.1"
## [15] "AT5G49980|AT5G49980.1"
## [16] "Glyma.16G050500|Glyma.16G050500.1"
## [17] "Glyma.16G146400|Glyma.16G146400.1"
## [18] "Glyma.04G093500|Glyma.04G093500.1"
## [19] "Glyma.02G065300|Glyma.02G065300.1"
## [20] "Glyma.02G211800|Glyma.02G211800.1"
## [21] "Glyma.02G254300|Glyma.02G254300.1"
## [22] "Glyma.02G152800|Glyma.02G152800.2"
## [23] "Glyma.10G021500|Glyma.10G021500.2"
## [24] "Glyma.08G059500|Glyma.08G059500.6"
## [25] "Glyma.07G189800|Glyma.07G189800.5"
## [26] "Glyma.11G227300|Glyma.11G227300.1"
## [27] "Glyma.14G179500|Glyma.14G179500.1"
## [28] "Glyma.14G062100|Glyma.14G062100.1"
## [29] "Glyma.06G095400|Glyma.06G095400.1"
## [30] "Glyma.03G209400|Glyma.03G209400.1"
## [31] "Glyma.19G100200|Glyma.19G100200.1"
## [32] "Glyma.19G206800|Glyma.19G206800.1"
## [33] "Glyma.18G030200|Glyma.18G030200.1"
## [34] "GlysoPI483463.19G168300|GlysoPI483463.19G168300.1"
## [35] "GlysoPI483463.03G169700|GlysoPI483463.03G169700.1"
## [36] "GlysoPI483463.14G141800|GlysoPI483463.14G141800.1"
## [37] "GlysoPI483463.02G212600|GlysoPI483463.02G212600.1"
## [38] "GlysoPI483463.02G175100|GlysoPI483463.02G175100.1"
## [39] "Lj1g0006513|Lj1g0006513.1"
## [40] "Lj1g0027142|Lj1g0027142.1"
## [41] "Lj1g0015670|Lj1g0015670.1"
## [42] "Lj3g0010583|Lj3g0010583.1"
## [43] "Lj5g0004781|Lj5g0004781.1"
## [44] "Lj6g0020395|Lj6g0020395.1"
## [45] "Lj4g0012889|Lj4g0012889.1"
## [46] "LOC_Os04g32460|LOC_Os04g32460.1"
## [47] "LOC_Os04g32460|LOC_Os04g32460.2"
## [48] "LOC_Os01g63420|LOC_Os01g63420.1"
## [49] "LOC_Os03g08850|LOC_Os03g08850.1"
## [50] "LOC_Os03g15880|LOC_Os03g15880.4"
## [51] "LOC_Os03g15880|LOC_Os03g15880.5"
## [52] "LOC_Os03g15880|LOC_Os03g15880.3"
## [53] "LOC_Os03g15880|LOC_Os03g15880.2"
## [54] "LOC_Os03g15880|LOC_Os03g15880.1"
## [55] "LOC_Os02g52230|LOC_Os02g52230.1"
## [56] "LOC_Os05g37690|LOC_Os05g37690.1"
## [57] "LOC_Os05g05800|LOC_Os05g05800.1"
## [58] "LOC_Os11g31620|LOC_Os11g31620.1"
```

```
Mult_AFB2 <- unique(Mult_AFB2)

# Biostrings::writeXStringSet(Mult_AFB2, "AFB_input/multi_AFB_final.fasta")

# Load from here fasta for alignment without Rice (removed all rice sequences manually)
```

```
Mult_AFB2 <- Biostrings::readAAStringSet(filepath = "AFB_input/")
```

```
## Warning in file(fp): 'raw = FALSE' but 'AFB_input/' is not a regular file
```

```
## Warning in file(fp): 'raw = FALSE' but 'AFB_input/' is not a regular file
```

```
names(Mult_AFB2)
```

```
## character(0)
```

```
Mult_AFB2 <- unique(Mult_AFB2)

# make alignment
(Mult_AFB_aligned <- DECIPHER::AlignSeqs(Mult_AFB2))
```

```
## Error in DECIPHER::AlignSeqs(Mult_AFB2): At least two sequences are required in myXStringSet.
```

```
# Fix names, because characters such as | are not accepted in MrBayes
names(Mult_AFB_aligned) <- stringr::str_remove(names(Mult_AFB_aligned), ".*\\|") # remove everything be
```

```
## Error in eval(expr, envir, enclos): object 'Mult_AFB_aligned' not found
```

```
# Biostrings::writeXStringSet(Mult_AFB2, "AFB_input/multi_AFB_aligned.fasta")
```

```
# write.csv(names(AFB_aligned), "AFB_IDs_all.csv")

# CUt low alignment regions by masking alignment
(multAFB_masked <- DECIPHER::MaskAlignment(Mult_AFB_aligned,
              type = "sequences",
              windowSize = 6, # same as aliscore default value.
              threshold = 1,
              maxFractionGaps = 0.2,
              includeTerminalGaps = FALSE,
              correction = FALSE,
              showPlot = FALSE))
```

```
## Error in eval(expr, envir, enclos): object 'Mult_AFB_aligned' not found
```

```
# make it a AAStringSet
AAstr_multAFB <- as(multAFB_masked, "AAStringSet")
```

```
## Error in eval(expr, envir, enclos): object 'multAFB_masked' not found
```

```
BrowseSeqs(AAstr_multAFB) # A few sequences seems really small, however I believe they will probably be
```

```
## Error in eval(expr, envir, enclos): object 'AAstr_multAFB' not found
```

```
writeXStringSet(AAstr_multAFB, file="AFB_input/masked_multAFB.fasta" )
```

```
## Error in eval(expr, envir, enclos): object 'AAstr_multAFB' not found
```

```
#Create a matrix so we can create the nexus file next
(matrix_multAFB <- as.matrix(AAstr_multAFB, use.names=TRUE))
```

```
## Error in h(simpleError(msg, call)): error in evaluating the argument 'x' in selecting a method for fu
```

```
# Also remove all the * from sequences because MrBayes does not like it
matrix_multAFB <-  sub("\\*", "-", matrix_multAFB)
```

```
## Error in h(simpleError(msg, call)): error in evaluating the argument 'x' in selecting a method for fu
```

```
DECIPHER::BrowseSeqs(AAStringSet(matrix_multAFB))
```

```
## Error in h(simpleError(msg, call)): error in evaluating the argument 'x' in selecting a method for fu
```

```
# Write nex file for MrBayes analysis
ape::write.nexus.data(matrix_multAFB, format = "protein",
                      file = "AFB_input/AFBmult_final.nex",
                      datablock = TRUE,
                      interleaved = TRUE,
                      charsperline = NULL,
                      gap = NULL, missing = NULL)
```

```
## Error in eval(expr, envir, enclos): object 'matrix_multAFB' not found
```

```
# Mbayes analysis were done following steps in AFB_Final.Rmd script
```

```
./mb

execute AFB_final.nex
# set  as the outgroup
outgroup AT2G39940.1

lset nucmodel=protein Rates=invgamma
# or include Nst=6  ngammacat=4 omegavar=M3
prset aamodelpr=fixed(jones) statefreqpr=fixed(empirical)
# initial run with aamodelpr=mixed yielded posterior prob of 1 for jones model
propset ExtTBR$prob=0

mcmcp stopval=0.01 stoprule=yes Mcmcdiagn=yes nchains=6 printfreq=1000 samplefreq=100 burnin=200 relburn
```

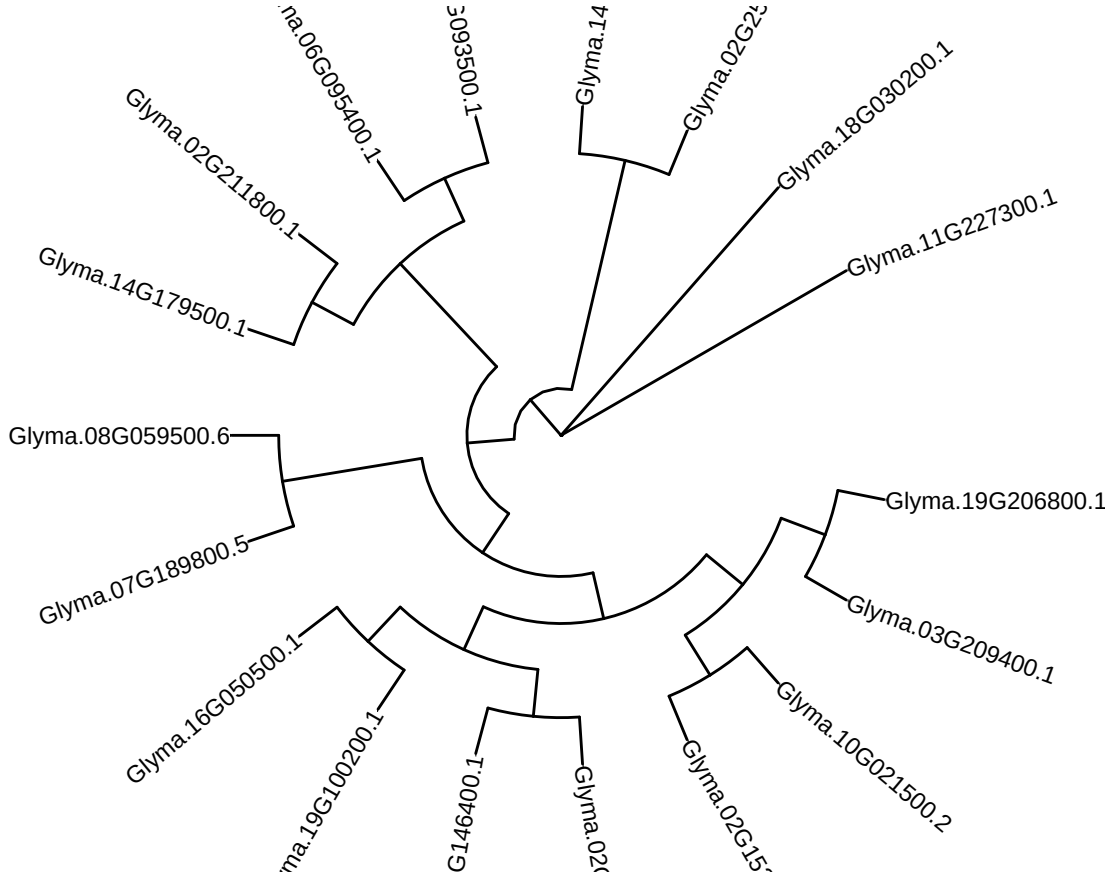
```
## bash: ./mb: No such file or directory
## bash: line 2: execute: command not found
## bash: line 4: outgroup: command not found
## bash: line 6: lset: command not found
## bash: -c: line 8: syntax error near unexpected token `('
## bash: -c: line 8: `prset aamodelpr=fixed(jones) statefreqpr=fixed(empirical) '
```

```
mcmc
sump
sumt
```

```
## Error in running command bash
```

build G. max tree

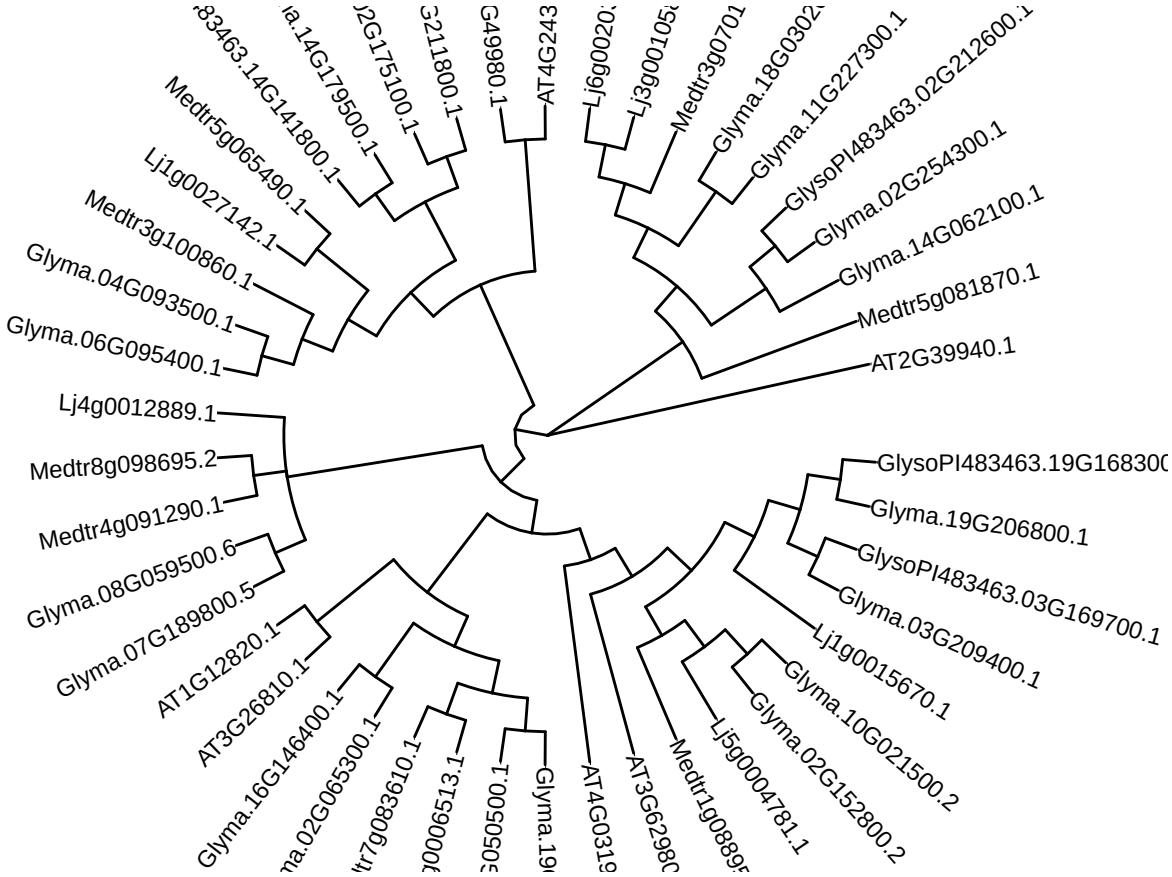
```
tree <- treeio::read.mrbayes(file = "AFB_input/mb_results/AFB_final.nex.con.tre")

ggtree(tree, layout="circular", branch.length = 'none') + geom_tiplab(size=3, align = T)
```




```
# ggsave("AFB_input/figures/g_max_mb_tree.pdf", height = 8, width = 7)
```

Build G. max tree with multiple species.

```
tree <- treeio::read.mrbayes(file = "AFB_input/mb_results_mult/AFBmult_final.nex.con.tre")

g_tree <- ggtree(tree, layout="circular", branch.length = 'none') + geom_tiplab(size=3, align = T)
g_tree
```




```
ggtree(tree, layout="circular",  color = "darkgrey",
       branch.length='prob', ladderize = TRUE) + geom_tiplab(align = F)+
  geom_text(aes(label=node), # node numbers
            size=3, hjust=-.3, color="red", fontface=2)
```


```
#ggsave("AFB_input/figures/AFB_nodes.pdf", width = 15, height = 15)
```

Get Class based on nodes and assign orthology based on Arabidopsis

```
class_COI1 <- data.frame(get_taxa_name(g_tree, node = 80)) # COI1
class_COI1 <- class_COI1 %>% dplyr::rename(tair_locus = `get_taxa_name.g_tree..node...80.`) %>%
  mutate(class = "COI1",
         name =ifelse(grepl("Glyma", .$tair_locus), "GmCOI1", ""),
         Clade = "V")

class_AFB4_5 <- data.frame(get_taxa_name(g_tree, node = 49)) # AFB4,5
class_AFB4_5 <- class_AFB4_5 %>% dplyr::rename(tair_locus = `get_taxa_name.g_tree..node...49.`) %>%
  mutate(class = "AFB4/5",
         name = ifelse(grepl("Glyma", .$tair_locus), "GmAFB4/5", ""),
         Clade = "IV")

class_AFB6 <- data.frame(get_taxa_name(g_tree, node = 59)) # AFB6
class_AFB6 <- class_AFB6 %>% dplyr::rename(tair_locus = `get_taxa_name.g_tree..node...59.`) %>%
  mutate(class = "AFB6",
         name = ifelse(grepl("Glyma", .$tair_locus), "GmAFB6", ""),
         Clade = "III")

class_AFB2_3 <- data.frame(get_taxa_name(g_tree, node = 64)) # AFB2_3
class_AFB2_3 <- class_AFB2_3 %>% dplyr::rename(tair_locus = `get_taxa_name.g_tree..node...64.`) %>%
  mutate(class = "AFB2/3",
         name = ifelse(grepl("Glyma", .$tair_locus), "GmAFB2/3", ""),
         Clade = "II")
```

```
class_TIR1_AFB1 <- data.frame(get_taxa_name(g_tree, node = 72)) # TIR1_AFB1
class_TIR1_AFB1 <- class_TIR1_AFB1 %>%
  dplyr::rename(tair_locus = `get_taxa_name.g_tree..node...72.`) %>%
  mutate(class = "TIR1/AFB1",
         name = ifelse(grepl("Glyma", .$tair_locus), "GmTIR1/AFB1", ""),
         Clade = "I")

TIR_AFB_class <- rbind(class_TIR1_AFB1, class_AFB2_3, class_AFB4_5, class_AFB6, class_COI1)

# Assign orthology
TIR_AFB_class <- TIR_AFB_class %>% mutate(ensembl_gene_id = str_remove_all(.$tair_locus, "\\.[^.]*$"))


Gm_ortholog <- TIR_AFB_class %>%
  dplyr::filter(str_detect(ensembl_gene_id, "Glyma")) %>%
  # arrange by tree order.
  group_by(name) %>% unique() %>%
  mutate(ortholog_name = dplyr::row_number()) %>%
  mutate(ortholog_name = paste0(name, "_", LETTERS[ortholog_name]))

#write_csv(Gm_ortholog, "AFB_input/AFB_Gm_ortholog.csv")

df4tips <- left_join(TIR_AFB_class, Gm_ortholog)
```

```
## Joining with `by = join_by(tair_locus, class, name, Clade, ensembl_gene_id)`
```

```
df4tips[c(27:28), 5] <- c("MtAFB6") #Assign AFB6 to IDs
df4tips[29, 5] <- c("LjAFB6")

df4tips2 <- within(df4tips, ortholog_name[is.na(ortholog_name)] <- tair_locus[is.na(ortholog_name)])
```

Now I want to join dataframe with nodes classification and tips and arabidopsis classification according to ViVa tool paper.

```
# change tips according to Arabidopsis classification
names <- as.data.frame(tree@phylo[["tip.label"]]) %>% dplyr::rename(tair_locus =`tree@phylo[["tip.label"

IDs <- readxl::read_xls("../Arquive/AFB_files/all_IDs.xls") %>%
  dplyr::rename(tair_locus =gene_IDs)
IDs
```

```
## # A tibble: 47 x 3
##    tair_locus      names               Source
##    <chr>           <chr>               <chr>
##  1 Medtr3g070140.1 Medtr3g070140.1     <NA>
##  2 Medtr3g100860.1 Medtr3g100860.1     <NA>
##  3 Medtr8g098695.2 Medtr8g098695.2/AFB6 https://www.ncbi.nlm.nih.gov/pmc/articl~
##  4 Medtr7g083610.1 Medtr7g083610.1     <NA>
##  5 Medtr5g065490.1 Medtr5g065490.1     <NA>
##  6 Medtr5g081870.1 Medtr5g081870.1     <NA>
##  7 Medtr1g088950.1 Medtr1g088950.1     <NA>
##  8 Medtr4g091290.1 Medtr4g091290.1     <NA>
##  9 AT2G39940.1     AT2G39940/COI1      <NA>
## 10 AT4G03190.1     AT4G03190/AFB1      <NA>
## # i 37 more rows
```

```r
all_Tip_IDs <- left_join(names, IDs[,-3]) %>%
  mutate(ensembl_gene_id = str_remove_all(tair_locus, "\\.[^.]*$"))
```

```
## Joining with `by = join_by(tair_locus)`
```

```r
TipLabel <- left_join(all_Tip_IDs, df4tips2)
```

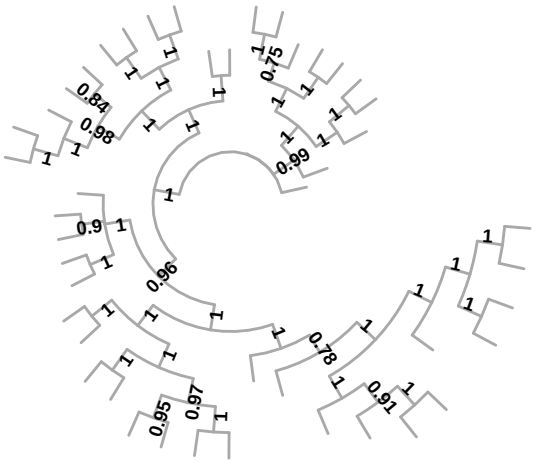
```
## Joining with `by = join_by(tair_locus, ensembl_gene_id)`
```

```r
TipLabel <- TipLabel %>% dplyr::rename(name_ID =names) %>% as.data.frame()

TipLabel2 <- cbind(TipLabel, replicate(1,TipLabel$name_ID)) %>%
  dplyr::rename(Tips_ID = `replicate(1, TipLabel$name_ID)`)

TipLabel2$name_ID <- gsub( ".*/", "At", TipLabel2$name_ID)

TipLabel2 <- within(TipLabel2, class[is.na(class)] <-
                      gsub("At", "", name_ID[is.na(class)]))

TipLabel2[c(3, 39),2] <- c("MtAFB6", "LjAFB6") # correct row 3 and 39 back to what they are. they are n

TipLabel2[c(1:2, 4:7, 915, 34:38, 40:45), 7] <- NA #ortholog_name column

# Join ortholog name with name_ID
TipLabel3 <-
  TipLabel2 %>% dplyr::relocate(ortholog_name, .after = name_ID) %>%
  unite("New_label",
        ortholog_name:name_ID,
        sep = "_",
        na.rm = T) #%>% .[,-c(5:6)]


# make a clade column for make visualization of tree easier to readers
TipLabel3 <- TipLabel3 %>%
  mutate(
    Clade = ifelse(grepl("COI", .$New_label), "V",
                   ifelse(
                     grepl("AFB1", .$New_label), "I",
                     ifelse(grepl("TIR1", .$New_label), "I",
                            ifelse(
                              grepl("AFB2", .$New_label), "II",
                              ifelse(grepl("AFB3", .$New_label), "II",
                                     ifelse(
                                       grepl("AFB4", .$New_label), "IV",
                                       ifelse(
                                         grepl("AFB5", .$New_label),
                                         "IV",
                                         ifelse(grepl("AFB6", .$New_label), "III",
                                           grepl("Medtr4g091290.1", .$New_label), "III", Clade
                                         ))
                                       )
                                     ))
                            ))
                   )),
    class = ifelse(
```

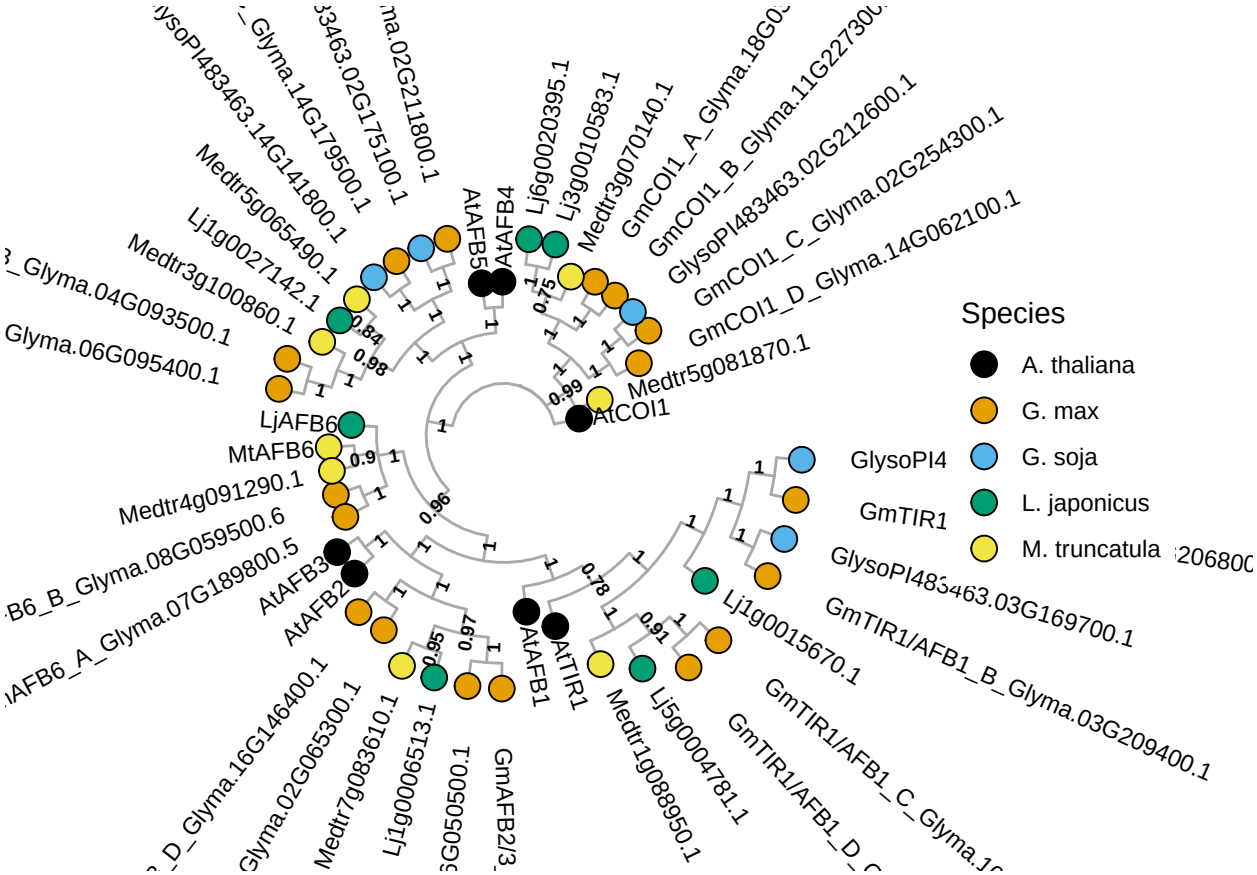
```
      grepl("Medtr8g098695.2", .$tair_locus),
      "AFB6",
      ifelse(grepl("Medtr4g091290.1", .$tair_locus), "AFB6", class)
    ),
    class = ifelse(
      grepl("COI", .$New_label),
      "COI1",
      ifelse(
        grepl("AFB1", .$New_label),
        "TIR1/AFB1",
        ifelse(
          grepl("TIR1", .$New_label),
          "TIR1/AFB1",
          ifelse(
            grepl("AFB2", .$New_label),
            "AFB2/3",
            ifelse(
              grepl("AFB3", .$New_label),
              "AFB2/3",
              ifelse(
                grepl("AFB4", .$New_label),
                "AFB4/5",
                ifelse(
                  grepl("AFB5", .$New_label),
                  "AFB4/5",
                  ifelse(grepl("LjAFB6", .$New_label), "AFB6", class)
                )
              )
            )
          )
        )
      )
    )
  )
```

```
#change tree tip.label
tree@phylo[["tip.label"]] <- TipLabel3[[2]][match(tree@phylo[["tip.label"]], TipLabel3[[1]])]

# Colour *Malus domestica* genes
TipLabel4 <- TipLabel3 %>%
  dplyr::select(tair_locus, New_label, ensembl_gene_id, class, Clade) %>%
  dplyr::mutate( Species = tair_locus )

TipLabel4$Species <- TipLabel4$Species %>%
  gsub("^AT(.*)", "A. thaliana", .) %>%
  gsub("^Medtr(.*)", "M. truncatula", .)  %>%
  gsub("^Glyma(.*)", "G. max", .) %>% gsub("^Glyso(.*)", "G. soja", .) %>%
  gsub("^Lj(.*)", "L. japonicus", .)

write_csv(IDs, "AFB_input/AFB_Ortho_Tip_Label.csv")
#read_csv("AFB_input/AFB_Ortho_Tip_Label.csv")
#tipLabel <- IDs[,-1]

p <- ggtree(tree, layout="circular",  color = "darkgrey",
```

```
      branch.length='prob', ladderize = TRUE) +
  scale_x_continuous(expand = c(0, 1.2)) +
  geom_nodelab(mapping = aes(label=round(
   as.numeric(prob), digits = 2), fontface=2),
    nudge_x = -.9, nudge_y = .2, hjust = -.05, size = 2.5)
p
```

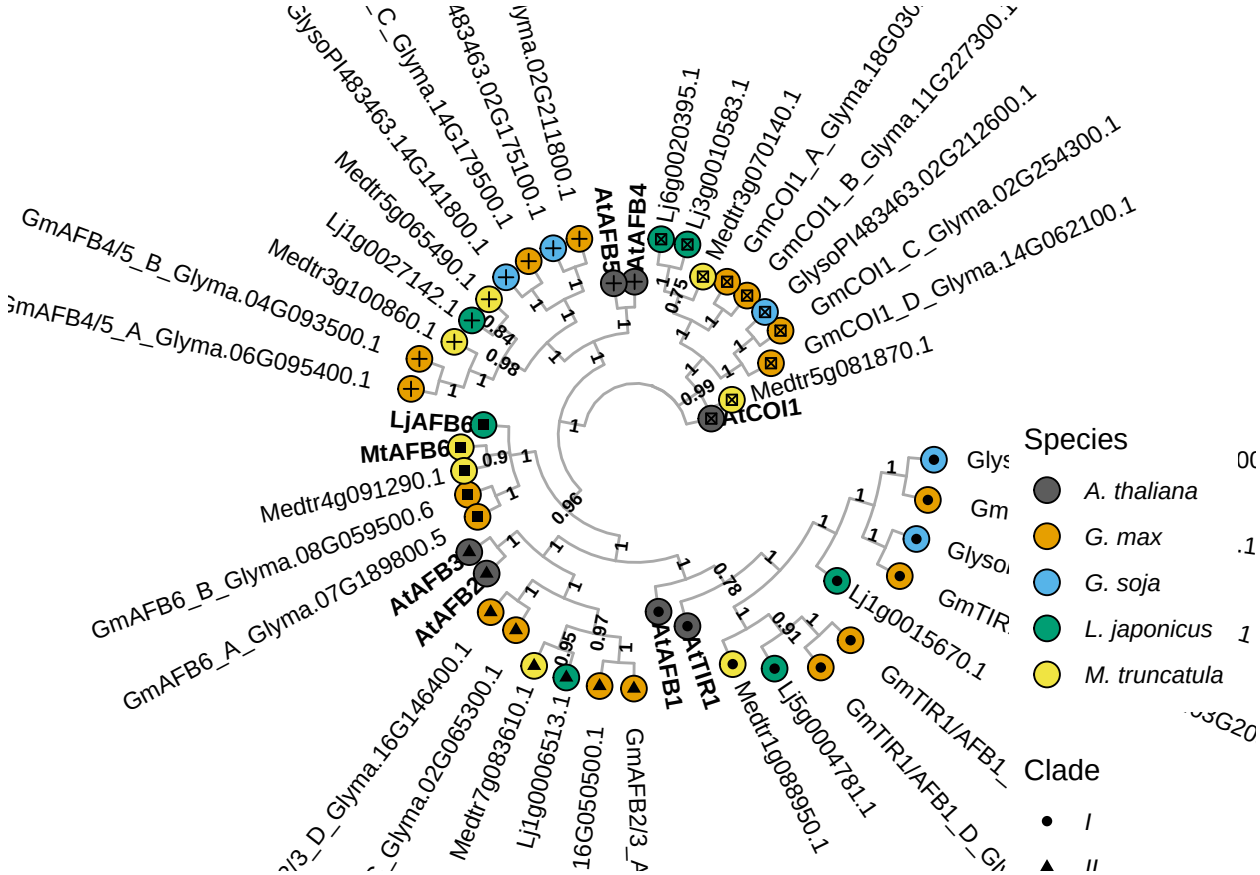



```
(p2 <- p %<+% TipLabel4[1:45,-1] +
  geom_tippoint(aes(fill=factor(Species)),
                size=4.2, shape=21) + geom_tiplab( size=3, hjust=-.15) +
  scale_fill_manual(values =
                      c('#000000', '#E69F00', '#56B4E9', '#009E73', '#F0E442')) + #COLORS FROM GGTHEMES
  guides(fill=guide_legend(title="Species"))
  )
```




```
tipLabel5 <- TipLabel4 %>%
   mutate(tip_color = ifelse(str_detect(New_label, "At"), "TO_not",
                             ifelse(str_detect(New_label, "LjA"), "TO_not",
                             ifelse(str_detect(New_label, "Mt"), "TO_not", "TO_color"))))

#tipLabel5 <- tipLabel5 %>%
#   mutate(tip_color = ifelse(str_detect(New_label, "At", negate = FALSE), "TO_color", #tip_color))

p %<+% tipLabel5[1:45,-1] +
  geom_tiplab(aes(subset=tip_color == "TO_not"), size=3, hjust=-.1, fontface=2)+ #subset tree in order
  geom_tiplab(aes(subset=tip_color == "TO_color"),
              colour='black', size=3, hjust=-.1) +
  geom_tippoint(aes(fill=factor(Species)),
                size=4.2, shape =21) + #geom_tiplab( size=3, hjust=-.15) +
  scale_fill_manual(values =
                      c('grey36', '#E69F00', '#56B4E9', '#009E73', '#F0E442')) + #COLORS FROM GGTHEMES
  guides(fill=guide_legend(title="Species")) +
  theme(legend.position = c(1.09,0.12)) +
  geom_point(aes(shape = Clade)) +
  theme(legend.text = element_text(face = "italic"))
```

```
## Warning: Removed 42 rows containing missing values (`geom_point()`).
```

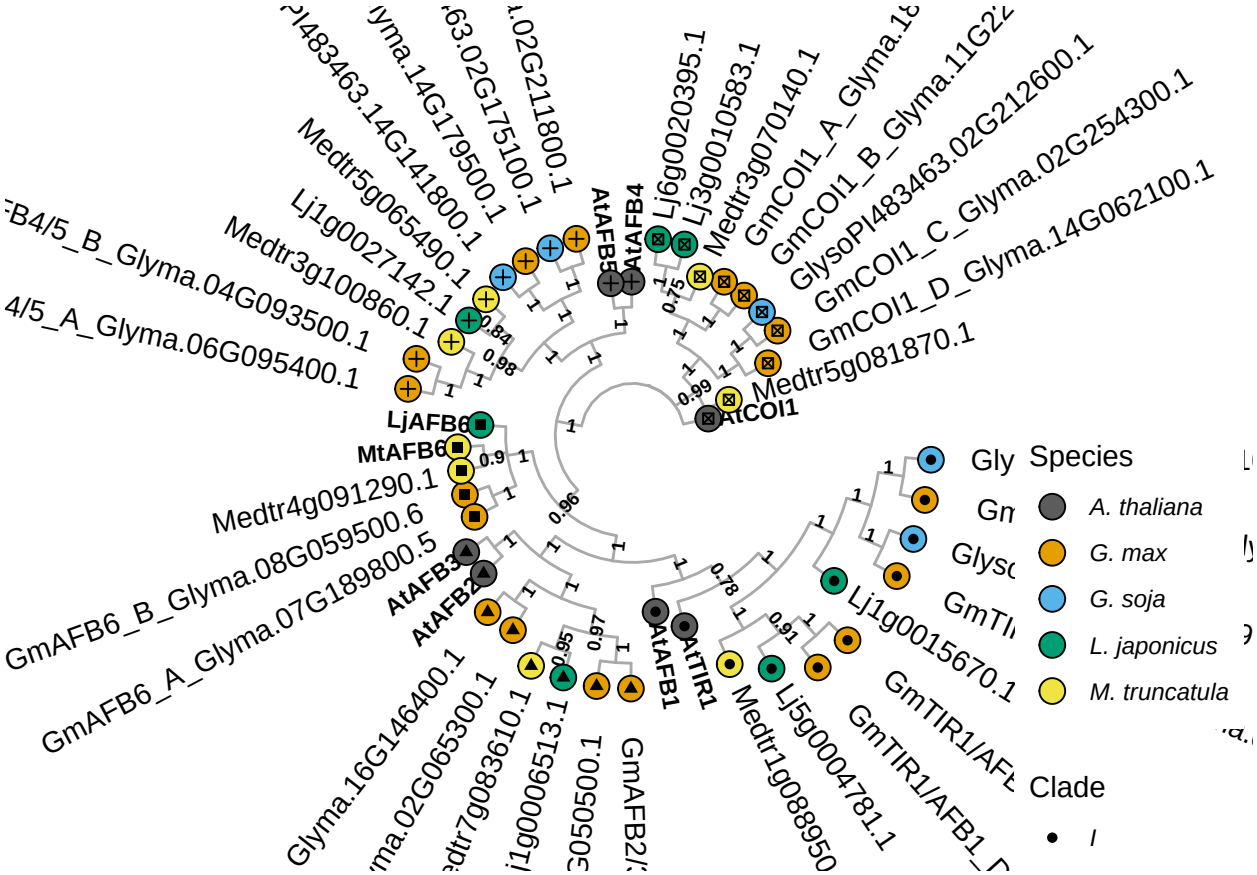



```
ggsave("AFB_input/figures/AFB_FINAL.pdf", height = 11, width = 14, dpi = 1000)
```

```
## Warning: Removed 42 rows containing missing values (`geom_point()`).
```

```
# save in png
p %<+% tipLabel5[1:45,-1] +
  geom_tiplab(aes(subset=tip_color == "TO_not"), size=3, hjust=-.1, fontface=2)+ #subset tree in order
  geom_tiplab(aes(subset=tip_color == "TO_color"),
              colour='black', size=4, hjust=-.1) +
  geom_tippoint(aes(fill=factor(Species)),
                size=4.2, shape =21) + #geom_tiplab( size=3, hjust=-.15) +
  scale_fill_manual(values =
                      c('grey36', '#E69F00', '#56B4E9', '#009E73', '#F0E442')) + #COLORS FROM GGTHEMES
  guides(fill=guide_legend(title="Species")) +
  theme(legend.position = c(1.10, 0.10)) +
  geom_point(aes(shape = Clade)) +
  theme(legend.text = element_text(face = "italic"))
```

```
## Warning: Removed 42 rows containing missing values (`geom_point()`).
```




```
ggsave("AFB_input/figures/AFB_FINAL.jpeg", height = 14, width = 18, dpi = 1000)
```

```
## Warning: Removed 42 rows containing missing values (`geom_point()`).
```