In [17]:
```
from Bio import Phylo
from io import StringIO
```

1. Program versions:
    - trimal-1.4.1
    - modeltest-ng-0.1.7
    - raxml-ng-1.2.1
    - ggtree v3.8.2
    - iqtree-2.2.6

2. Trimming alignment with trimal

In [4]:
```
!trimal -in SUP35_aln_prank.best.fas -out SUP35_aln_prank.trim.fas -
automated1
```

3. Choosing best evolutionary model

In [5]:
```
!modeltest-ng -i SUP35_aln_prank.trim.fas -o SUP35_trim_modeltest | grep
-C 10 'Summary'
```

```
modeltest-ng: Results file SUP35_trim_modeltest.out already exists
modeltest-ng: - Remove the existing files, or
modeltest-ng: - Select a different output basename (-o argument), or
modeltest-ng: - Force overriding (--force argument)
```

4. Build ML-tree based on best model (TIM3+G4)

In [6]:
```
!raxml-ng --msa SUP35_aln_prank.trim.fas --model TIM3+G4 --prefix
SUP35_raxml --threads 2 --seed 222  --outgroup SUP35_Kla_AB039749
```

```
ERROR: Result files for the run with prefix `SUP35_raxml` already exist!
Please either choose a new prefix, remove old files, or add --redo command
line switch to overwrite them.
```

5. Visualize this tree

In [22]:
```
file = open("SUP35_raxml.raxml.bestTree", "r")
treedata = file.read()
file.close()

handle = StringIO(treedata)
tree = Phylo.read(handle, "newick")

Phylo.draw_ascii(tree)
```

```
                  ____________________________ SUP35_Agos_ATCC_10895_NM_211584
                 |
                 |                          _____ SUP35_Skud_IFO1802T_36
                 |                        |
                 |                        |      , SUP35_Scer_74-D694_GCA_001578265.1
          _______|                        |      |
         |       |                        |    __| SUP35_Scer_beer078_CM005938
         |       |                        |   |  |
         |       |                        |  _|  | SUP35_Sbou_unique28_CM003560
         |       |                        | | |
         |       |________________________|_| |_ SUP35_Spar_A12_Liti
       _|                                | |
         |                                | |____ SUP35_Smik_IFO1815T_30
         |                                |
         |                                |____ SUP35_Sarb_H-6_chrXIII_CM001575
         |                                |
         |                                |______ SUP35_Seub_CBS12357_chr_II_IV_DF9685
       35
         |
         |________ SUP35_Kla_AB039749
```

6. Choose best model via IQ-TREE

In [26]:
```
!iqtree2 -m MFP -s SUP35_aln_prank.trim.fas --prefix SUP35_MF2 | grep
'Best-fit model'
```

```
Best-fit model: TIM3+F+G4 chosen according to BIC
```

7. TIM3+F+G4 model has fixed frequences

8. Buildinf IQ-TREE best tree

In [31]:
```
!iqtree2 -m TIM3+F+G4 -s SUP35_aln_prank.trim.fas --prefix SUP35_iqtree
> /dev/null
```

9. Draw best tree

In [27]:
```
file = open("SUP35_MF2.treefile", "r")
treedata = file.read()
file.close()

handle = StringIO(treedata)
tree = Phylo.read(handle, "newick")

Phylo.draw_ascii(tree)
```

```
 ____________________ SUP35_Kla_AB039749
|
|_____________________________ SUP35_Agos_ATCC_10895_NM_211584
|
|                                    , SUP35_Scer_74-D694_GCA_001578265.1
|                                    |
|                                ___| SUP35_Scer_beer078_CM005938
|                              |   |
|                            __|   | SUP35_Sbou_unique28_CM003560
|                           |  |
|                         _|  |__ SUP35_Spar_A12_Liti
|                        | |
|                        | |_____ SUP35_Smik_IFO1815T_30
|_______________________|
                        |  ______ SUP35_Sarb_H-6_chrXIII_CM001575
                        |,|
                        |||________ SUP35_Seub_CBS12357_chr_II_IV_DF968
535
                         |
                         |_______ SUP35_Skud_IFO1802T_36
```

10. log-likelihood

In [ ]:

11. Base command for 100 bootstrap replics

In [ ]:
```
!iqtree2 -s SUP35_aln_prank.trim.fas -m TIM3+F+G4 -pre SUP35_TIM3_b -b
10
```

12. Ultra-fast bootstrap 1000

In [ ]:
```
!iqtree2 -s SUP35_aln_prank.trim.fas -m TIM3+F+G4 -redo -pre
SUP35_TIM3_ufb -bb 1000
```

14. • 1000 uftrafast bootstrap + 1000 alrt + abayes

In [ ]:
```
!iqtree2 -s SUP35_aln_prank.trim.fas -m TIM3+F+G4 -pre
SUP35_TIM3_B_alrt_abayes -bb 1000 -alrt 1000 -abayes
```