S1. Methods and results of maximum parsimony (MP) and maximum likelihood (ML) analyses

S1.1. Methods

We used TNT [1] for maximum parsimony (MP) analyses. Two independent MP analyses were made:

1) the first inference was performed using a heuristic search with 1,000 replications (saving at most 100 trees in each replication) of random (stepwise) addition of taxa followed by Tree Bisection Reconnection (TBR) branch swapping. Two additional runs using trees on memory were performed to refine searches. To evaluate branch support we made 10,000 replicates of standard bootstrap.

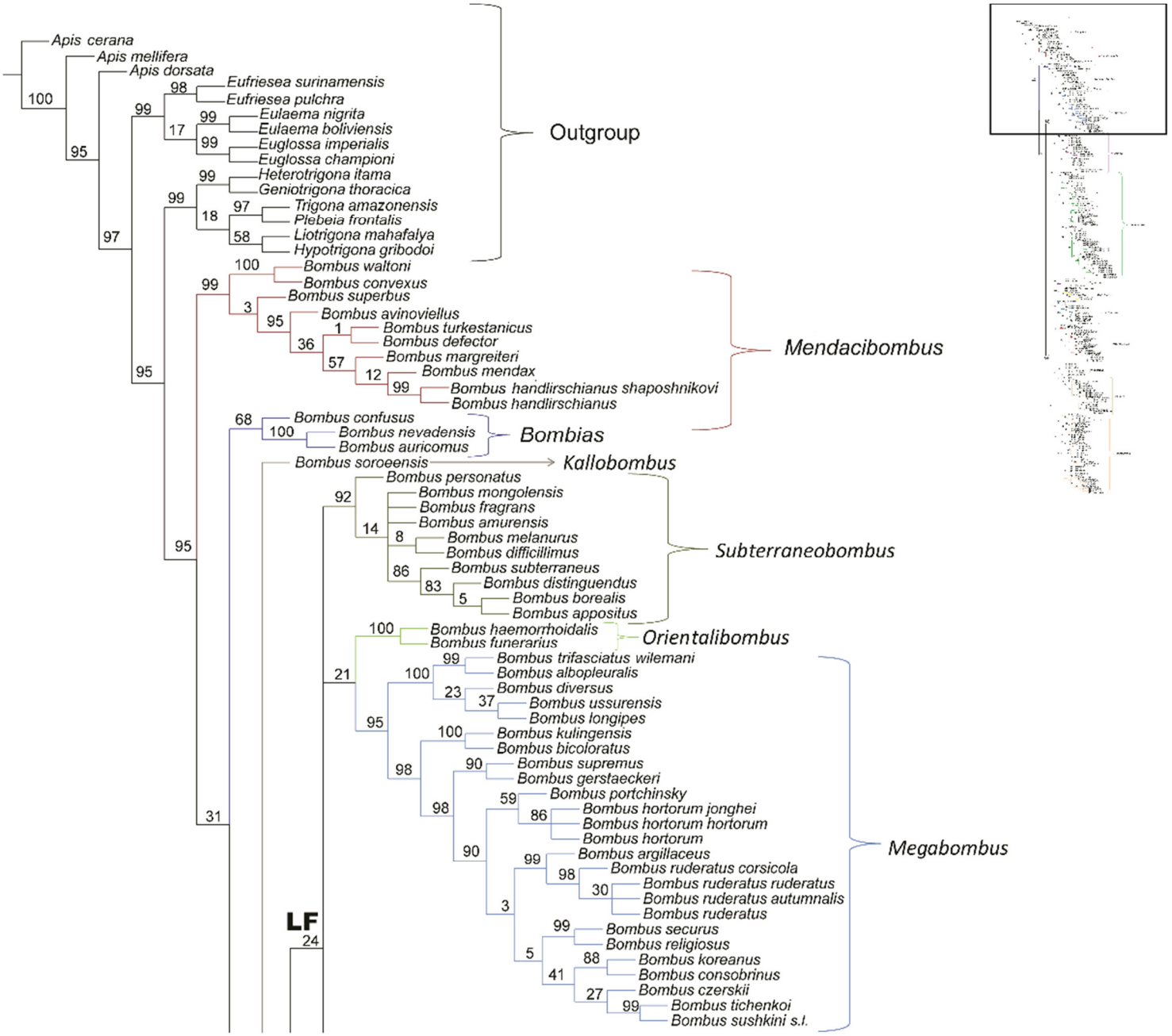
2) the second inference was performed using new technology search (NTS) with sectorial search, ratchet, tree-drifting and tree fusing options and 10 random addition sequences (saving at most 100 trees in each replication). Trees resulting from such analyses were submitted to an additional round of TBR. To evaluate branch support in the resulting trees, we made 10,000 replicates of standard bootstrap.

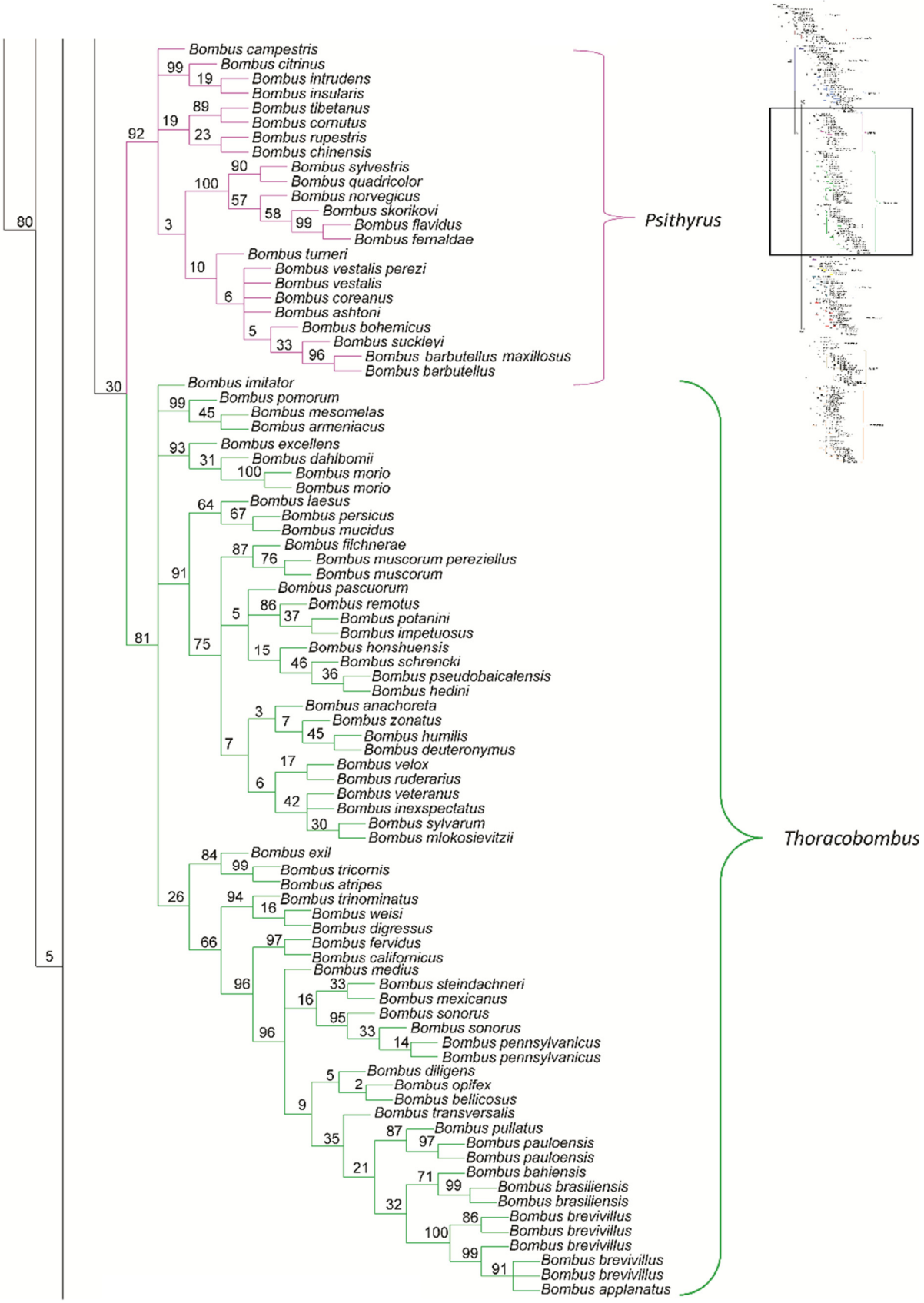
A maximum likelihood analysis (ML) was performed in RAxML version 8 [2]. The model GTR+G was used for all partitions obtained with PartitionFinder v.2.1.1 [3] and 1,000 bootstrap replicates search were used to calculate branch support (ML optimizations were performed every five bootstrap replicates and were followed by a final search for the best-scoring ML tree once bootstrap search was over). We also used the program IQ-TREE [4] for an alternative ML analysis, which differs from RAxML by using flexible models' definitions and a fast bootstrap approximation with algorithm UFBoot2 [5].

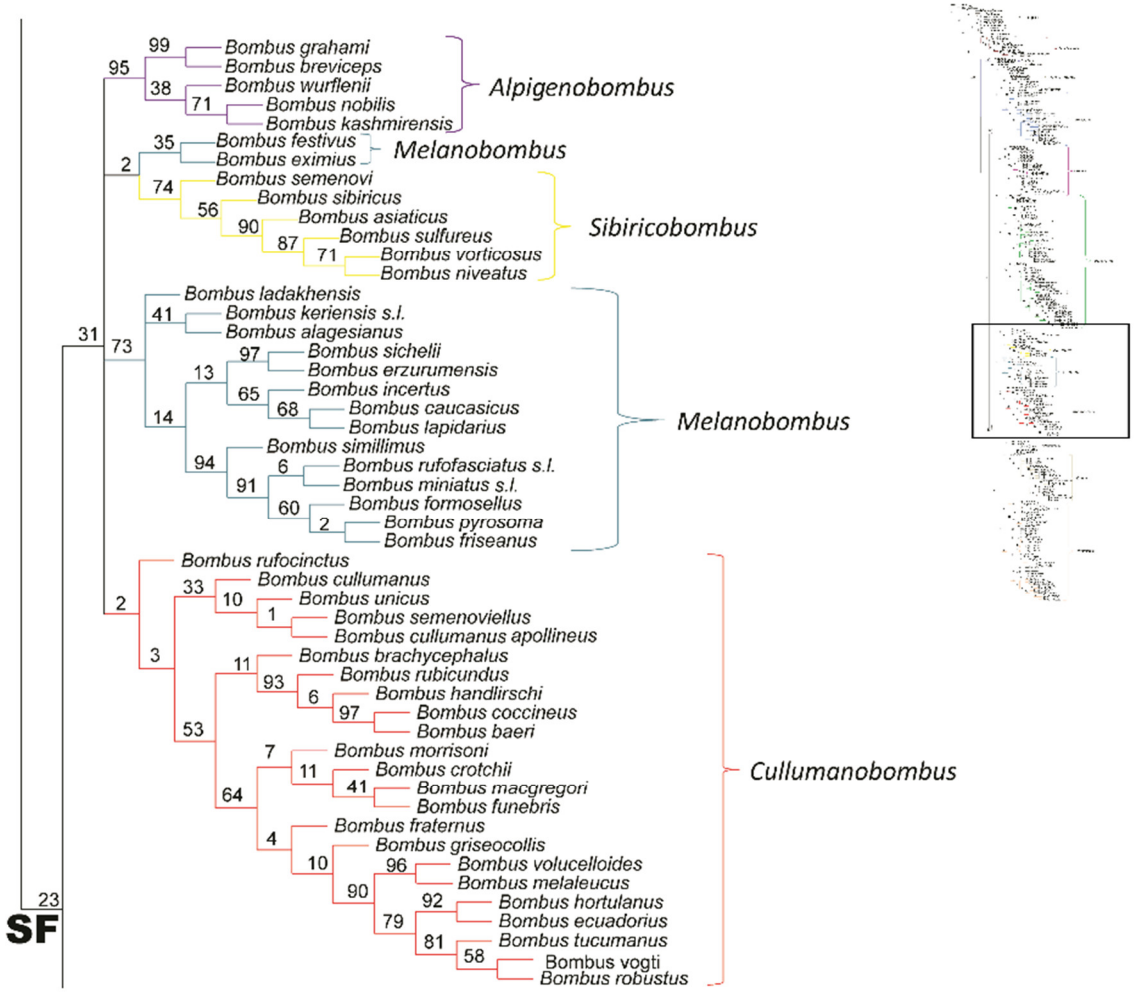
S1.2. Results

The best scores of MP were 13,176 and 14,493 for the analyses without NTS and with NTS, respectively (total rearrangements examined 21,224,652,872 and 21,145,970,952; Figures S7 and S8). The subgenera *Alpigenobombus, Melanobombus, Sibiricobombus* and *Cullumanobombus* arised in a polytomy, where *B.* (*Melanobombus*) *festivus* and *B.* (*Melanobombus*) *eximius* grouped with *Sibiricobombus*, making *Melanobombus* paraphyletic. In the MP analyses *Thoracobombus* is paraphyletic, *B. laesus* grouped with *Psithirus* (Figure S7). The ML tree obtained with RaxML recovered *B. rufocinctus* as part of a polytomy, leaving the subgenera *Cullumanobombus* paraphyletic. The polytomy was composed of *Cullumanobombus* + *Sibiricobombus* + *B. (Cullumanobombus) rufocinctus* (Figure S9).

All subgenera were monophyletic in ML analyses obtained with IQ-TREE, although some of them were supported by low bootstrap values. The relationships among species within some subgenera were not well resolved or were weakly supported (Figure S10).


Apis cerana
Apis mellifera
Apis dorsata
Eufriesea surinamensis
Eufriesea pulchra
Eulaema nigrita
Eulaema boliviensis
Euglossa imperialis
Euglossa championi
Heterotrigona itama
Geniotrigona thoracica
Trigona amazonensis
Plebeia frontalis
Liotrigona mahafalya
Hypotrigona gribodoi
Outgroup
Bombus waltoni
Bombus convexus
Bombus superbus
Bombus avinoviellus
Bombus turkestanicus
Bombus defector
Bombus margreiteri
Bombus mendax
Bombus handlirschianus shaposhnikovi
Bombus handlirschianus
Mendacibombus
Bombus confusus
Bombus nevadensis
Bombus auricomus
Bombias
Bombus soroeensis
Kallobombus
Bombus personatus
Bombus mongolensis
Bombus fragrans
Bombus amurensis
Bombus melanurus
Bombus difficillimus
Bombus subterraneus
Bombus distinguendus
Bombus borealis
Bombus appositus
Subterraneobombus
Bombus haemorrhoidalis
Bombus funerarius
Orientalibombus
Bombus trifasciatus wilemani
Bombus albopleuralis
Bombus diversus
Bombus ussurensis
Bombus longipes
Bombus kulingensis
Bombus bicoloratus
Bombus supremus
Bombus gerstaeckeri
Bombus portchinsky
Bombus hortorum jonghei
Bombus hortorum hortorum
Bombus hortorum
Bombus argillaceus
Bombus ruderatus corsicola
Bombus ruderatus ruderatus
Bombus ruderatus autumnalis
Bombus ruderatus
Bombus securus
Bombus religiosus
Bombus koreanus
Bombus consobrinus
Bombus czerskii
Bombus tichenkoi
Bombus sushkini s.l.
Megabombus
LF


Bombus campestris
Bombus citrinus
Bombus intrudens
Bombus insularis
Bombus tibetanus
Bombus cornutus
Bombus rupestris
Bombus chinensis
Bombus sylvestris
Bombus quadricolor
Bombus norvegicus
Bombus skorikovi
Bombus flavidus
Bombus fernaldae
Bombus turneri
Bombus vestalis perezi
Bombus vestalis
Bombus coreanus
Bombus ashtoni
Bombus bohemicus
Bombus suckleyi
Bombus barbutellus maxillosus
Bombus barbutellus
Psithyrus
Bombus imitator
Bombus pomorum
Bombus mesomelas
Bombus armeniacus
Bombus excellens
Bombus dahlbomii
Bombus morio
Bombus morio
Bombus laesus
Bombus persicus
Bombus mucidus
Bombus filchnerae
Bombus muscorum pereziellus
Bombus muscorum
Bombus pascuorum
Bombus remotus
Bombus potanini
Bombus impetuosus
Bombus honshuensis
Bombus schrencki
Bombus pseudobaicalensis
Bombus hedini
Bombus anachoreta
Bombus zonatus
Bombus humilis
Bombus deuteronymus
Bombus velox
Bombus ruderarius
Bombus veteranus
Bombus inexspectatus
Bombus sylvarum
Bombus mlokosievitzii
Bombus exil
Bombus tricornis
Bombus atripes
Bombus trinominatus
Bombus weisi
Bombus digressus
Bombus fervidus
Bombus californicus
Bombus medius
Bombus steindachneri
Bombus mexicanus
Bombus sonorus
Bombus sonorus
Bombus pennsylvanicus
Bombus pennsylvanicus
Bombus diligens
Bombus opifex
Bombus bellicosus
Bombus transversalis
Bombus pullatus
Bombus pauloensis
Bombus pauloensis
Bombus bahiensis
Bombus brasiliensis
Bombus brasiliensis
Bombus brevivillus
Bombus brevivillus
Bombus brevivillus
Bombus brevivillus
Bombus brevivillus
Bombus applanatus
Thoracobombus


Bombus grahami
Bombus breviceps
Bombus wurflenii
Bombus nobilis
Bombus kashmirensis
Alpigenobombus
Bombus festivus
Bombus eximius
Melanobombus
Bombus semenovi
Bombus sibiricus
Bombus asiaticus
Bombus sulfureus
Bombus vorticosus
Bombus niveatus
Sibiricobombus
Bombus ladakhensis
Bombus keriensis s.l.
Bombus alagesianus
Bombus sichelii
Bombus erzurumensis
Bombus incertus
Bombus caucasicus
Bombus lapidarius
Bombus simillimus
Bombus rufofasciatus s.l.
Bombus miniatus s.l.
Bombus formosellus
Bombus pyrosoma
Bombus friseanus
Melanobombus
Bombus rufocinctus
Bombus cullumanus
Bombus unicus
Bombus semenoviellus
Bombus cullumanus apollineus
Bombus brachycephalus
Bombus rubicundus
Bombus handlirschi
Bombus coccineus
Bombus baeri
Bombus morrisoni
Bombus crotchii
Bombus macgregori
Bombus funebris
Bombus fraternus
Bombus griseocollis
Bombus volucelloides
Bombus melaleucus
Bombus hortulanus
Bombus ecuadorius
Bombus tucumanus
Bombus vogti
Bombus robustus
Cullumanobombus
SF

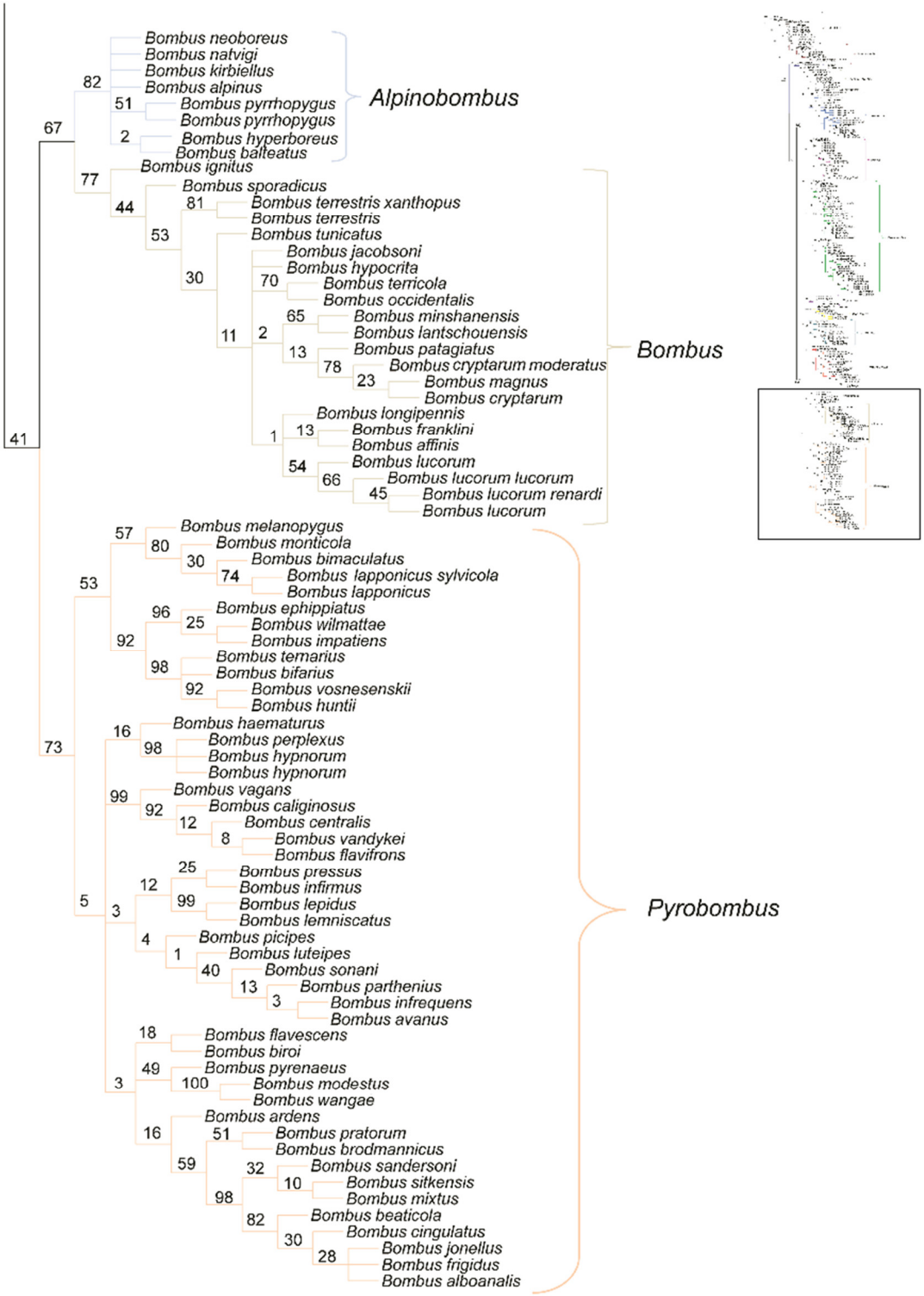
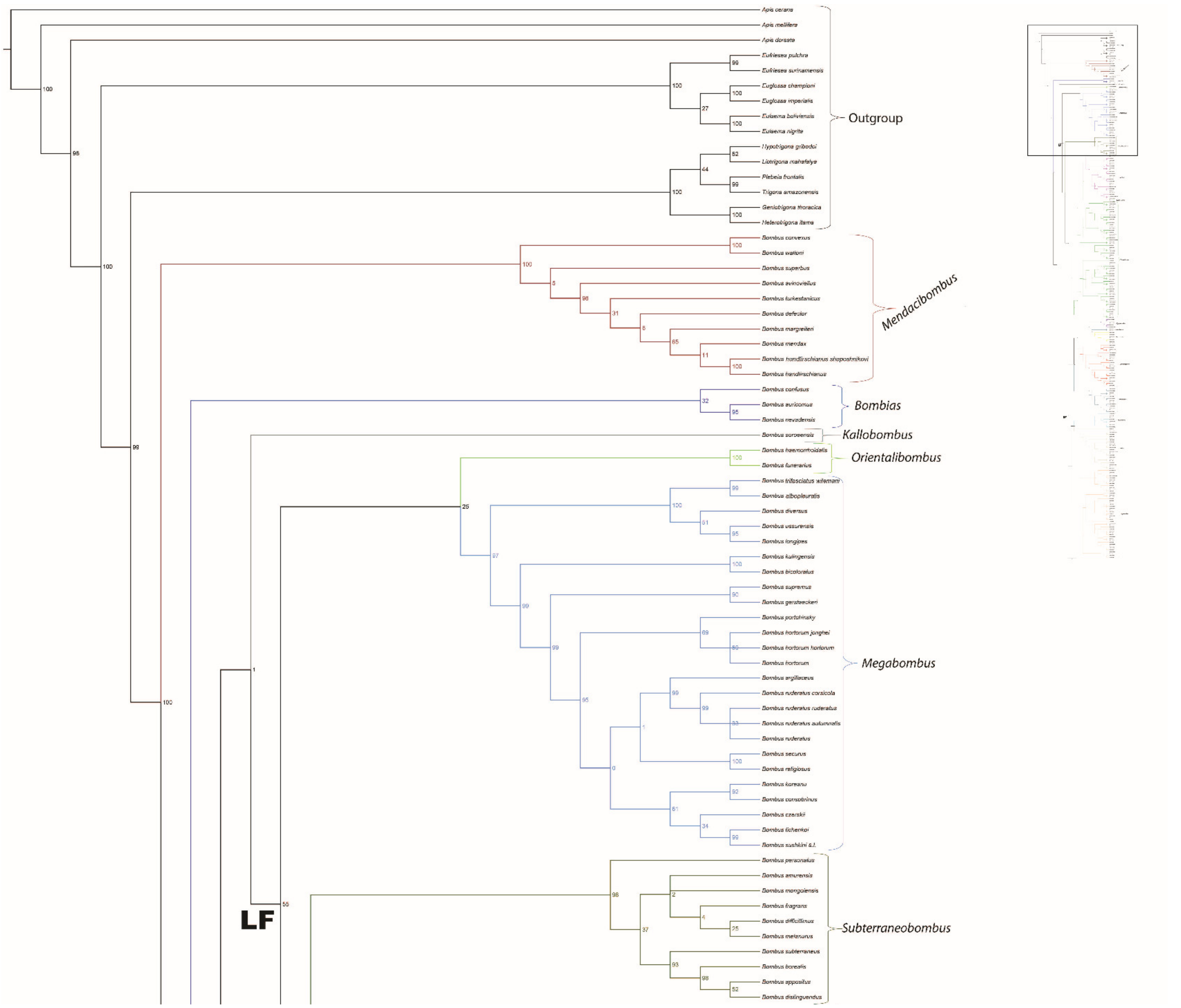


Figure S7. Strict consensus tree of Maximum Parsimony – MP analysis of bumblebees' species. Topologies recovered with the data of matrix presented in Table S5. The values shown above each branch are bootstrap values. Tree performed using a heuristic search with 1000 replications (saving at most 100 trees in each replication) of random (stepwise) addition of taxa followed by Tree Bisection Reconnection (TBR) branch swapping. Two additional runs using trees on memory were performed to refine searches. To evaluate branch supports we made 10,000 replicates of standard bootstrap. Sister groups of the long-faced (LF) and short-faced (SF) bumblebees were shown.


Outgroup
Mendacibombus
Bombias
Kallobombus
Orientalibombus
Megabombus
LF
Subterraneobombus


Bombus campestris
Bombus citrinus
Bombus insularis
Bombus inirudens
Bombus tibetanus
Bombus cornutus
Bombus rupestris
Bombus chinensis
Bombus sylvestris
Bombus quadricolor
Bombus norvegicus
Bombus skorikovi
Bombus flavidus
Bombus fernaldae
Bombus turneri
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Bombus barbutellus
Psithyrus
Bombus laesus
Thoracobombus
Bombus anachoreta
Bombus deuteronymus
Bombus humilis
Bombus impetuosus
Bombus potanini
Bombus remotus
Bombus zonatus
Bombus inexspectatus
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Bombus veteranus
Bombus ruderarius
Bombus velox
Bombus pascuorum
Bombus honshuensis
Bombus schrencki
Bombus hedini
Bombus pseudobaicalensis
Bombus filchnerae
Bombus muscorum
Bombus muscorum pereziellus
Bombus mucidus
Bombus persicus
Bombus imitator
Bombus pomorum
Bombus armeniacus
Bombus mesomelas
Bombus excellens
Bombus dahlbomii
Bombus morio
Bombus morio
Thoracobombus
Bombus medius
Bombus transversalis
Bombus brevivillus
Bombus brevivillus
Bombus applanatus
Bombus brevivillus
Bombus brevivillus
Bombus brevivillus
Bombus bahiensis
Bombus brasiliensis
Bombus brasiliensis
Bombus pullatus
Bombus paulensis
Bombus paulensis
Bombus diligens
Bombus bellicosus
Bombus opifex
Bombus mexicanus
Bombus steindachneri
Bombus sonorus
Bombus sonorus
Bombus pennsylvanicus
Bombus pennsylvanicus
Bombus californicus
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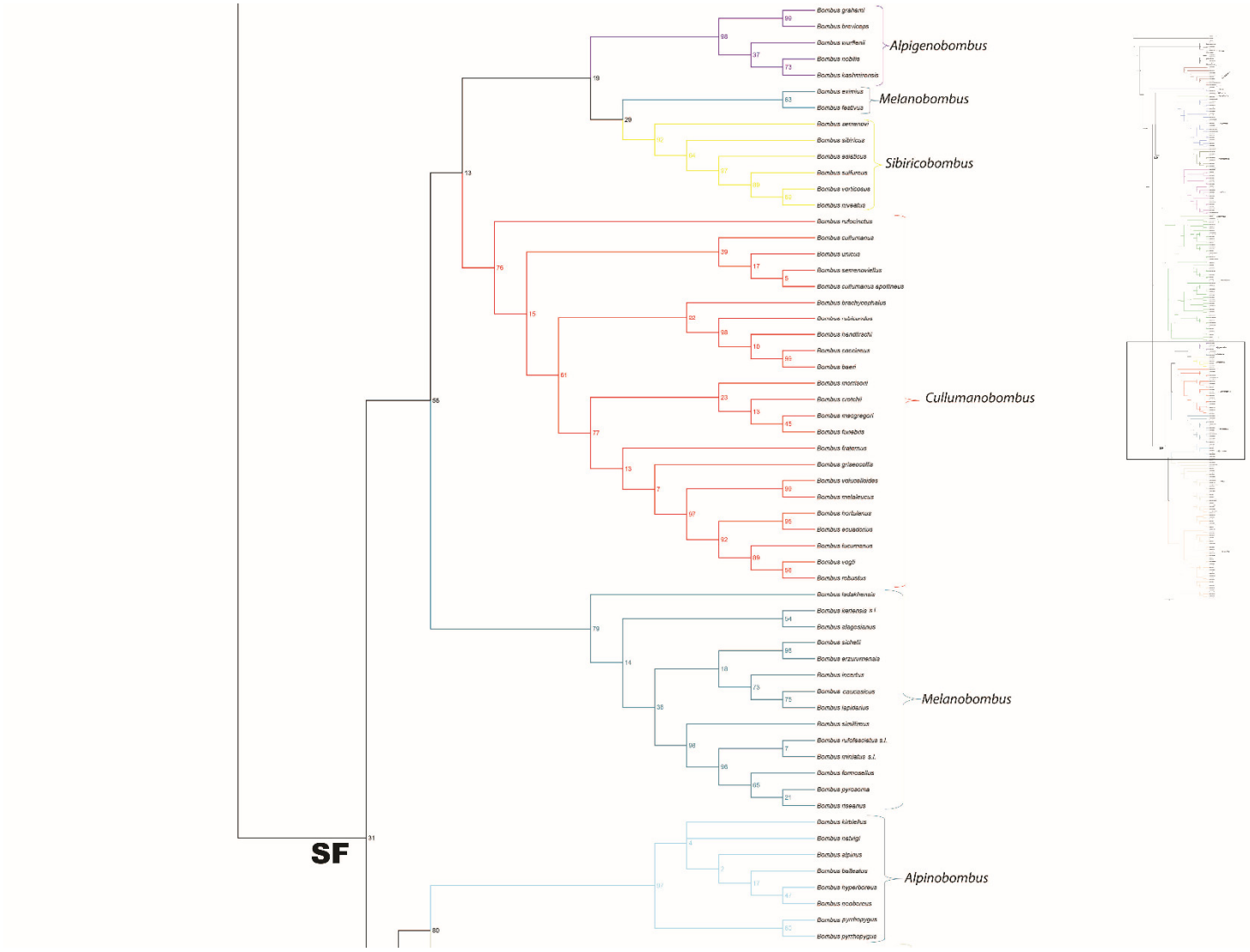
Bombus digressus
Bombus trinominatus
Bombus weisi
Bombus exil
Bombus atripes
Bombus ricornis


Alpigenobombus
Melanobombus
Sibiricobombus
Cullumanobombus
Melanobombus
Alpinobombus
SF

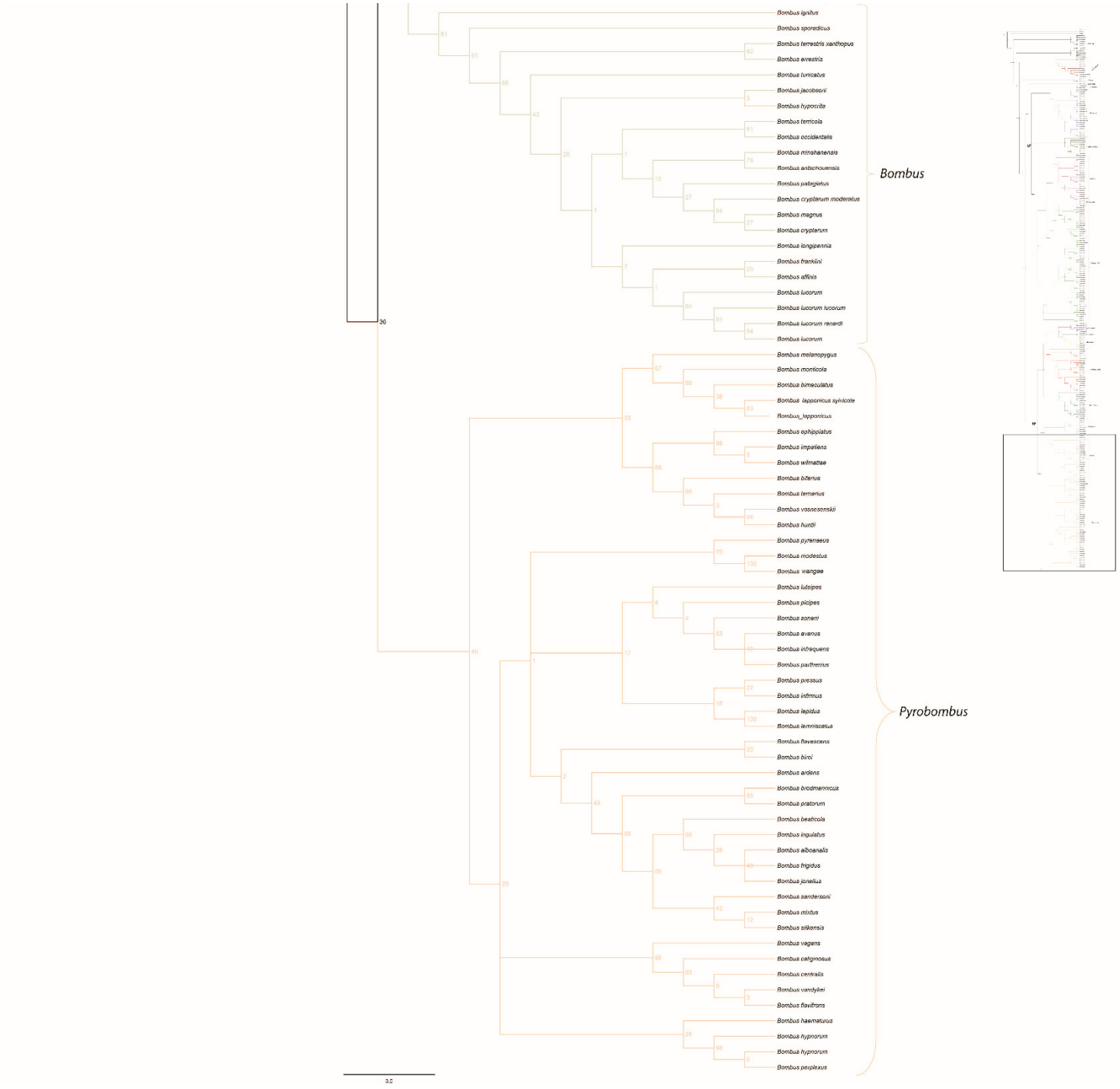
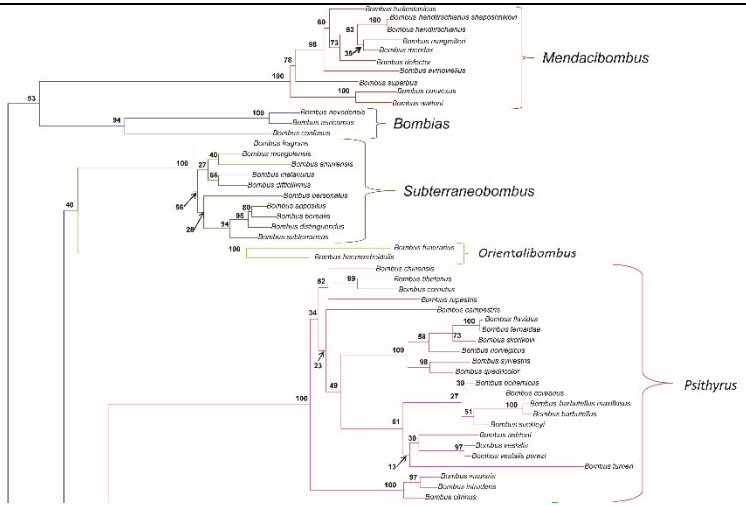
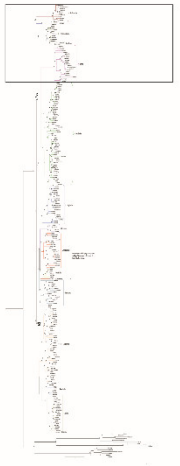


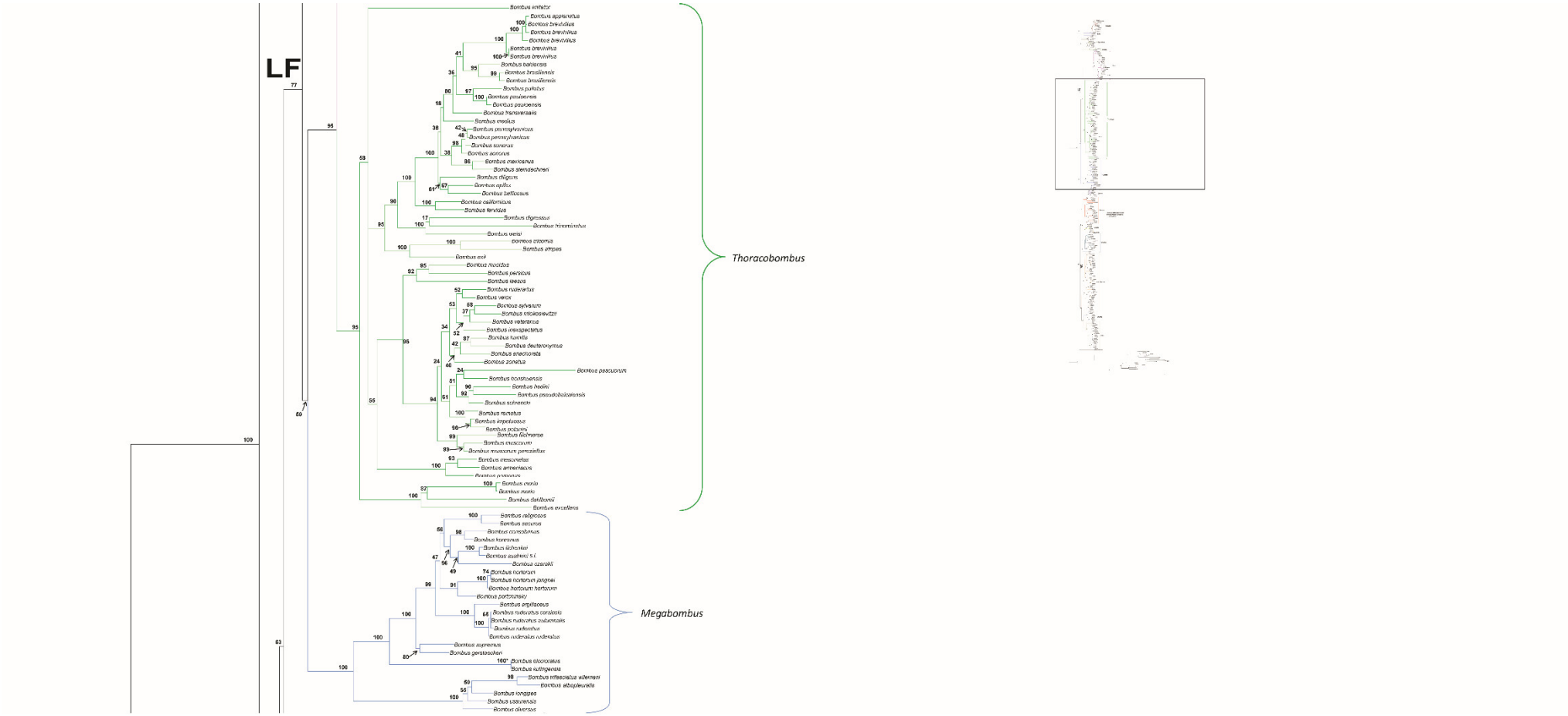
Figure S8. Strict consensus tree of Maximum Parsimony – MP analysis of bumblebees' species. Topologies recovered with the data of matrix presented in Table S5. The values shown around each branch are bootstrap values. Tree performed using new technology search (NTS) with sectorial search, ratchet, drift and tree fusing options and 10 random addition sequences (saving at most 100 trees in each replication). After analysis with the new technology search were used a round of Tree Bisection Reconnection (TBR). To evaluate branch supports we made 10,000 replicates of standard bootstrap. Sister groups of the long-faced (LF) and short-faced (SF) bumblebees were shown.

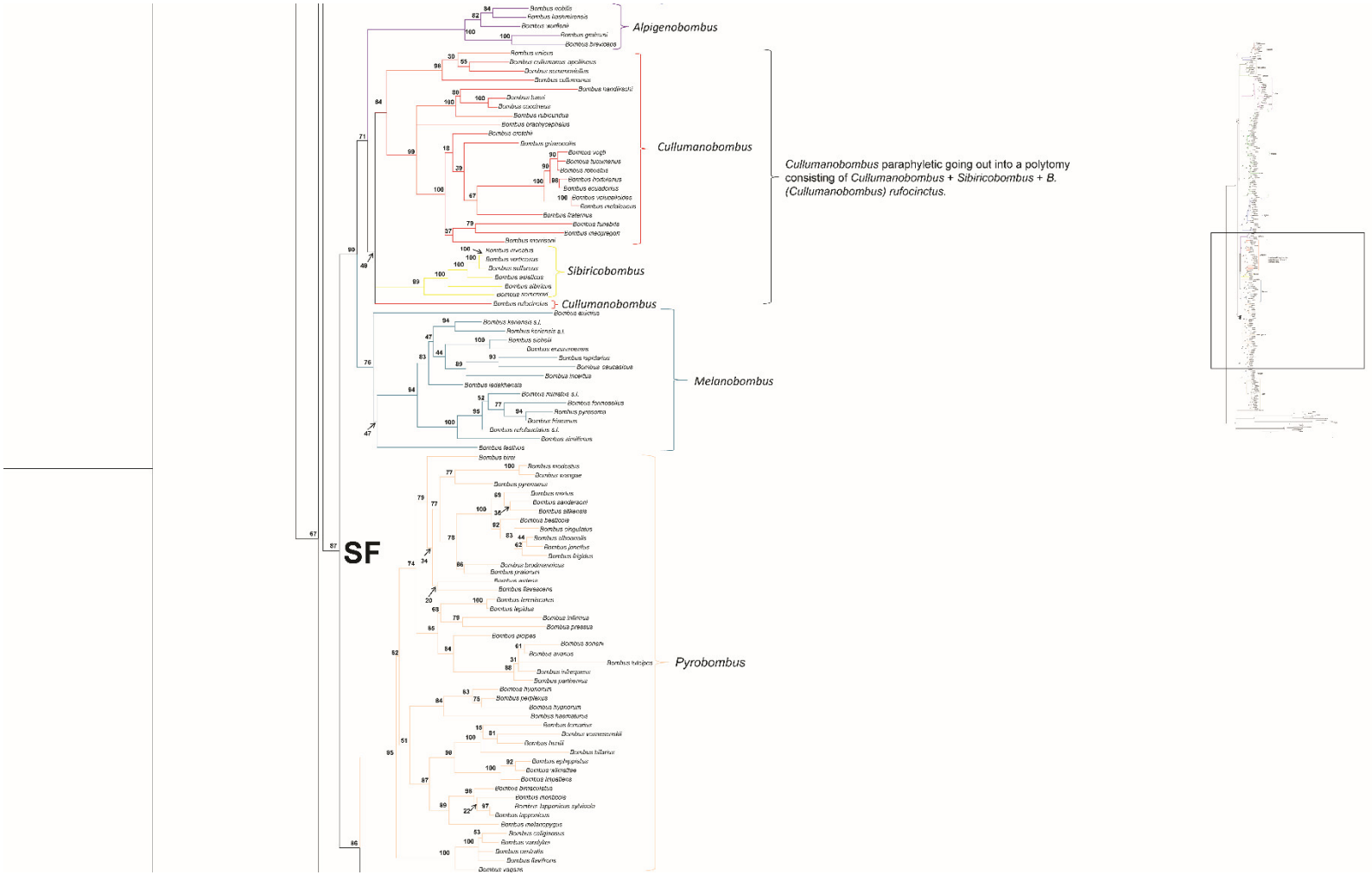
diversity

MDPI






LF
Thoracobombus
Megabombus


Alpigenobombus
Cullumanobombus
Sibiricobombus
Cullumanobombus
Melanobombus
SF
Pyrobombus
Cullumanobombus paraphyletic going out into a polytomy consisting of Cullumanobombus + Sibiricobombus + B. (Cullumanobombus) rufocinctus.

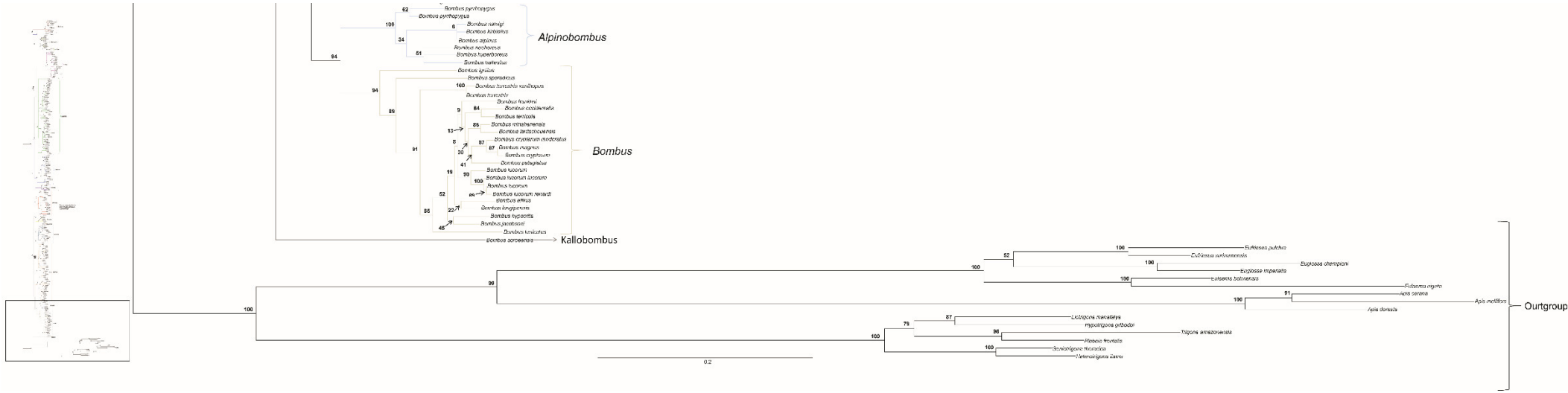
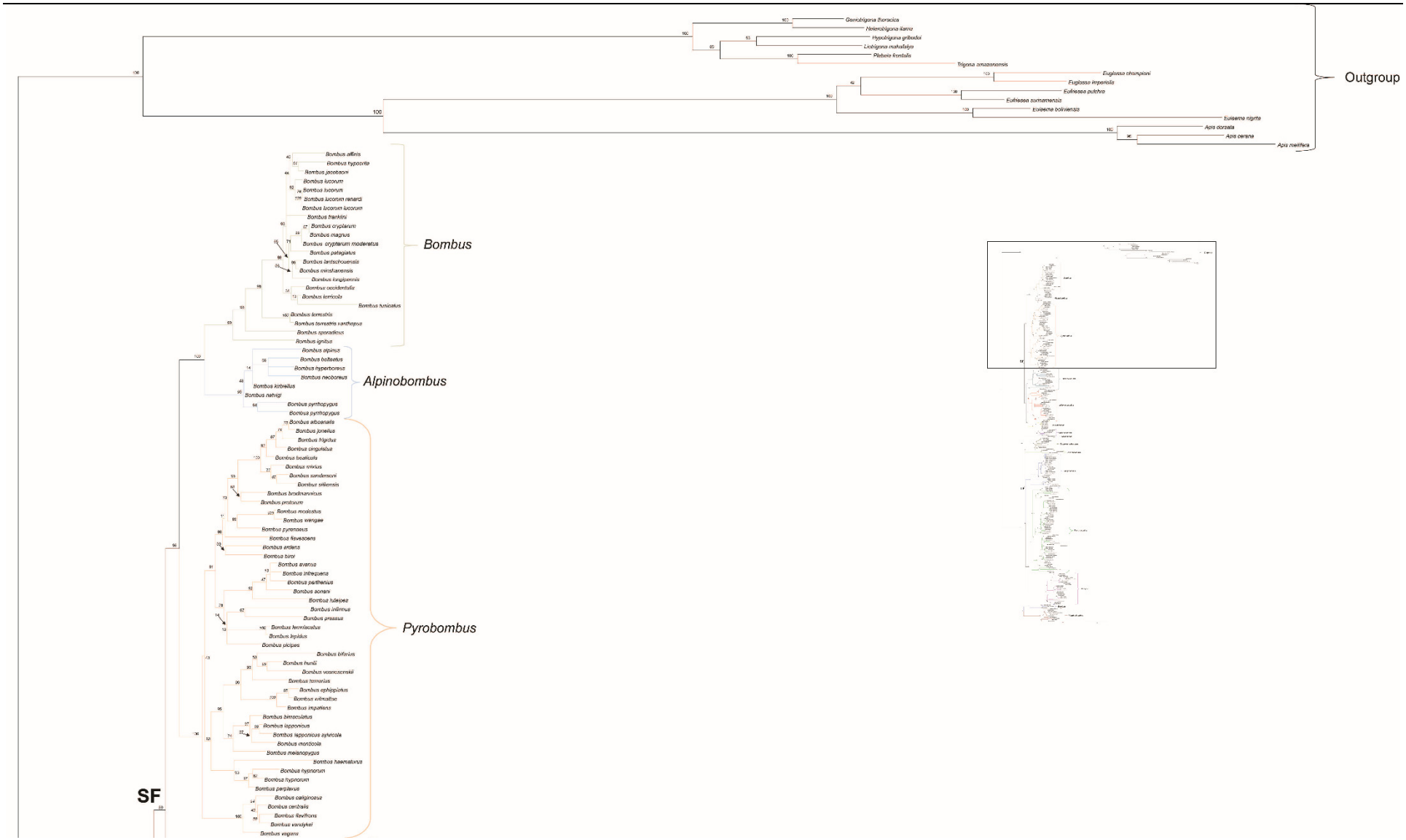
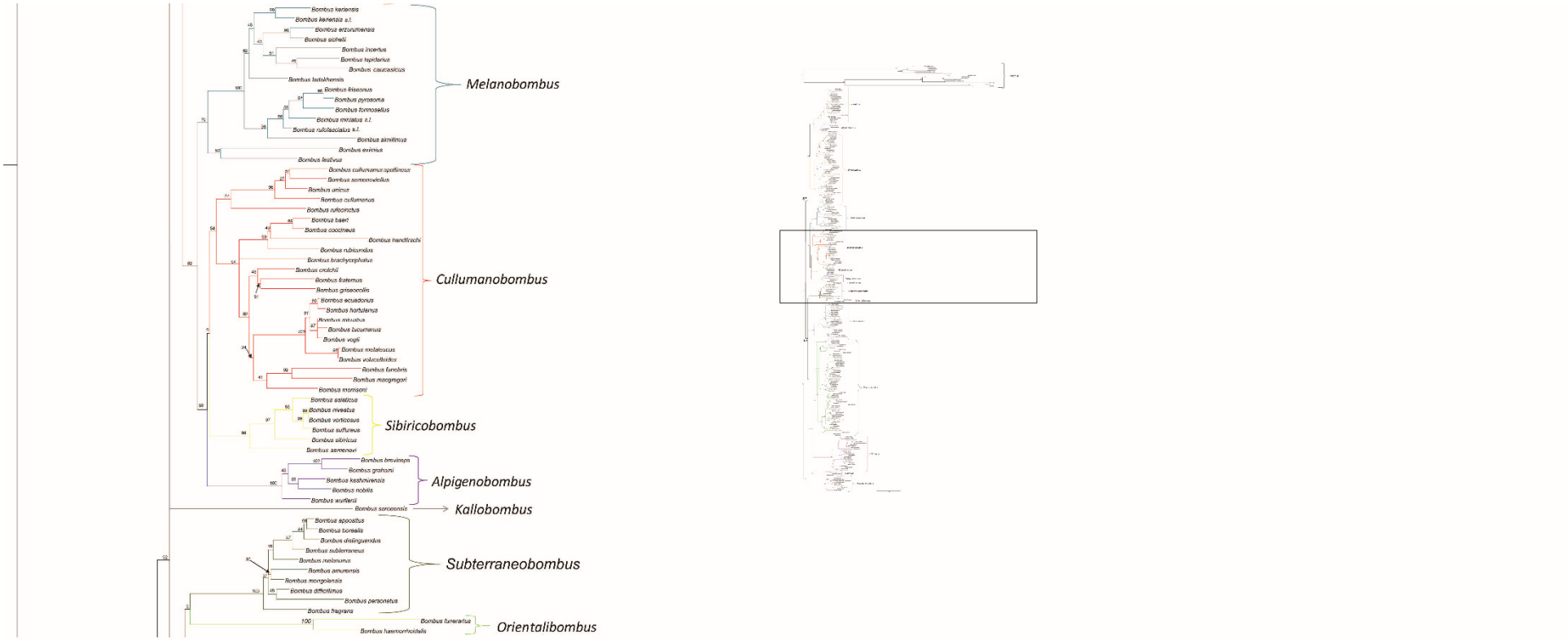


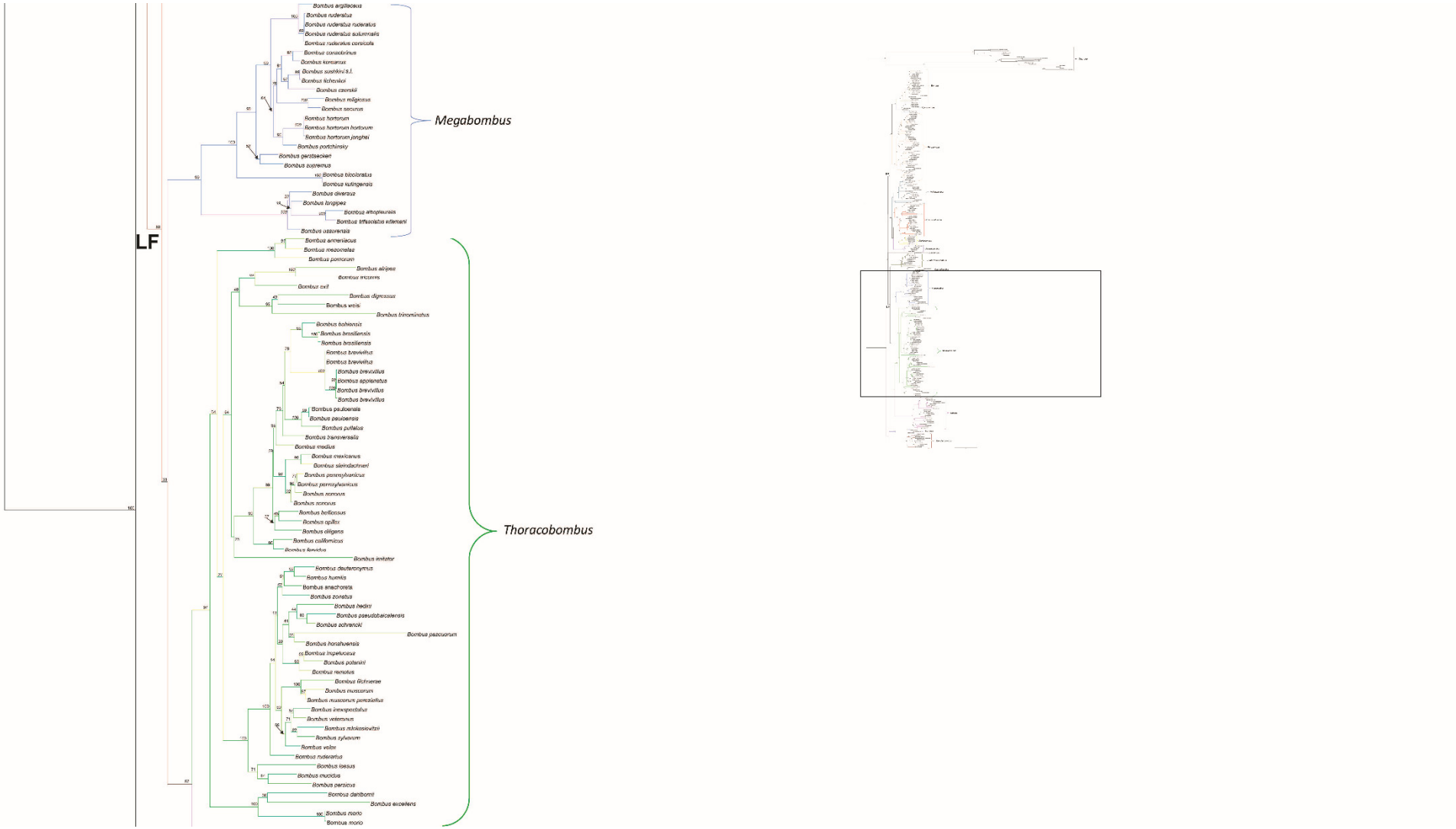
Figure S9. Maximum Likelihood tree – ML search obtained with RAxML. Topologies recovered with the data of matrix presented in Table S5. Bootstrap support values are indicated above each branch. Sister groups of the long-faced (LF) and short-faced (SF) bumblebees were shown.

diversity

MDPI




Melanobombus
Cullumanobombus
Sibiricobombus
Alpigenobombus
Kallobombus
Subterraneobombus
Orientalibombus


Megabombus
LF
Thoracobombus

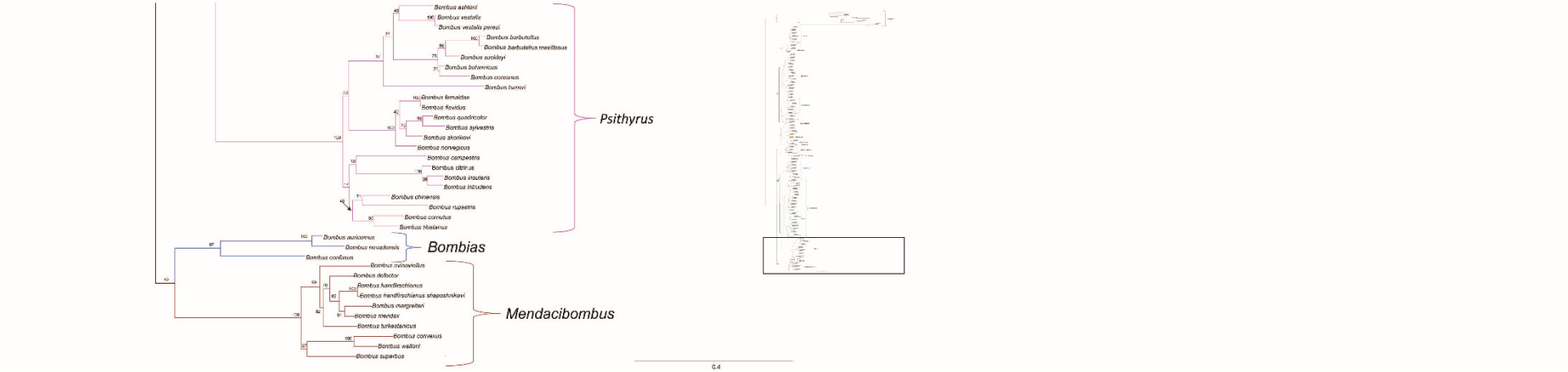


Figure S10. Maximum Likelihood tree – ML search obtained with IQ-TREE. Topologies recovered with the data of matrix presented in Supplementary Table S5. Bootstrap support values are indicated above each branch. Sister groups of the long-faced (LF) and short-faced (SF) bumblebees were shown.

S2. Priors for divergence time estimation

Divergence time estimates. We describe here the paleontological evidence upon which our nine calibration points are based.

Calibration 1 – The fossil bee *Euglossa moronei* Engel, 1999, which is from Miocene Dominican Republic amber [6]. Based on biostratigraphic and paleogeographic data, Dominican amber has been dated from of late Early Miocene through early Middle Miocene age (20.43–13.65 Ma; [7]). For this calibration point, we applied a lognormal distribution with mean of 1.0, Stdev of 0.8 and offset of 15 Ma (95% HPD: 15.6–28 Ma) to the node uniting *Euglossa* subgenus.

Calibration 2 – *Apis lithohermaea* Engel, 2006 is the oldest fossil record for crown group *Apis* (15.97–13.65 Ma). The fossil is from the Chôjabaru Formation of Iki Island, Japan which has been estimated to be from the middle Miocene. Based on some key morphological characters, it was assigned to the *dorsata* species group and was described as being quite similar to modern *Apis dorsata* [8]. This fossil therefore provides a minimum age for the diversification of *Apis dorsata* from *Apis cerana*, a member of the *mellifera* species group. A lognormal distribution with mean of 1.0, Stdev of 0.8 and offset of 10 Ma (95% HPD: 10.6–23 Ma) was applied as a prior for most recent common ancestor between *A. dorsata* and *A. cerana.*

Calibration 3 – The fossil *bee Eulaema (Apeulaema) zigrasi* Engel, 2014 (23.03–15.97 Ma), which is from Early Miocene Mexican amber [9]. For this calibration point, we applied a lognormal distribution with mean of 0.8 and Stdev of 0.9 and offset of 16 Ma (95% HPD: 16.4–29 Ma) to the node uniting *Apeulaema* species.

Calibration 4 – The fossil bee *Paleoeuglossa melissiflora* Poinar, 1998 (20.43–13.65 Ma), which is from Dominican Republic [10]. Belongs to *Eufriesea* according to Engel *et al.* [11]. For this calibration point, we applied a lognormal distribution with mean of 0.8 and Stdev of 0.9 and offset of 14 Ma (95% HPD: 14.4–27 Ma) to the node uniting *Eufriesea* species.

Calibration 5 – The fossil bee *Bombus (Bombus) randeckensis* Wappler & Engel, 2012 (18.97–13.65 Ma), which is from the Miocene Randeck Maar of southwestern Germany [12]. For this calibration point, we applied lognormal distribution with a mean of 0.8 and Stdev of 1 and offset of 14 Ma (95% HPD: 14.3–29.8 Ma) to the node uniting *Bombus* s.str.

Calibration 6 – *Oligobombus cuspidatus* Antropov, 2014 (37.2–33.9 Ma), which if from the Late Eocene Bembridge Marls (A'Court Smith Collection) [13]. It likely belongs to stem-group Bombini as well *Calyptapis florissantensis* Cockerell, 1906 [14]. For this calibration point, we applied a lognormal distribution with mean of 1.2 and Stdev of 0.7 and offset of 33 Ma (95% HPD: 33.8–46.1 Ma) to the node uniting *Bombus* species.

Calibration 7 – *Cretotrigona prisca* (Michener & Grimaldi, 1988) (70.6–66.043 Ma) is the oldest fossil bee and the oldest record of eusocial behavior among the Apoidea [15]. This fossil is from Late Cretaceous New Jersey amber, Delaware River, Kinkora [16]. For this calibration point, we applied a lognormal distribution with mean of 1 and Stdev of 0.9 and offset of 66 Ma (95% HPD: 66.5–81.9 Ma) to the node uniting Meliponina.

Calibration 8. The fossil bees *Liotrigonopsis rozeni* Engel, 2001 and *Kelneriapis eocenica* (Kelner-Pillault, 1969) these fossils are from eocenic Baltic amber (AMNH collection) [17]. For this calibration point, we applied a lognormal distribution with mean of 1 and Stdev of 0.8 and offset of 40 Ma (95% HPD: 40.6–53 Ma) to the node uniting *Liotrigona* and *Hypotrigona.*

Calibration 9 – The fossil bee *Bombus (Cullumanobombus) trophonius* Prokop, Dehon, Michez, Engel, 2017 (20.0–16.9 Ma), which is from the Early Miocene deposits of deposits of the Most Basin at the Bílina Mine, Czech Republic [18]. For this calibration point, we applied lognormal distribution with a mean of 1 and Stdev of 0.3 and offset of 15.9 Ma (95% HPD: 17.6–20.4 Ma) to the node uniting *Cullumanobombus*.

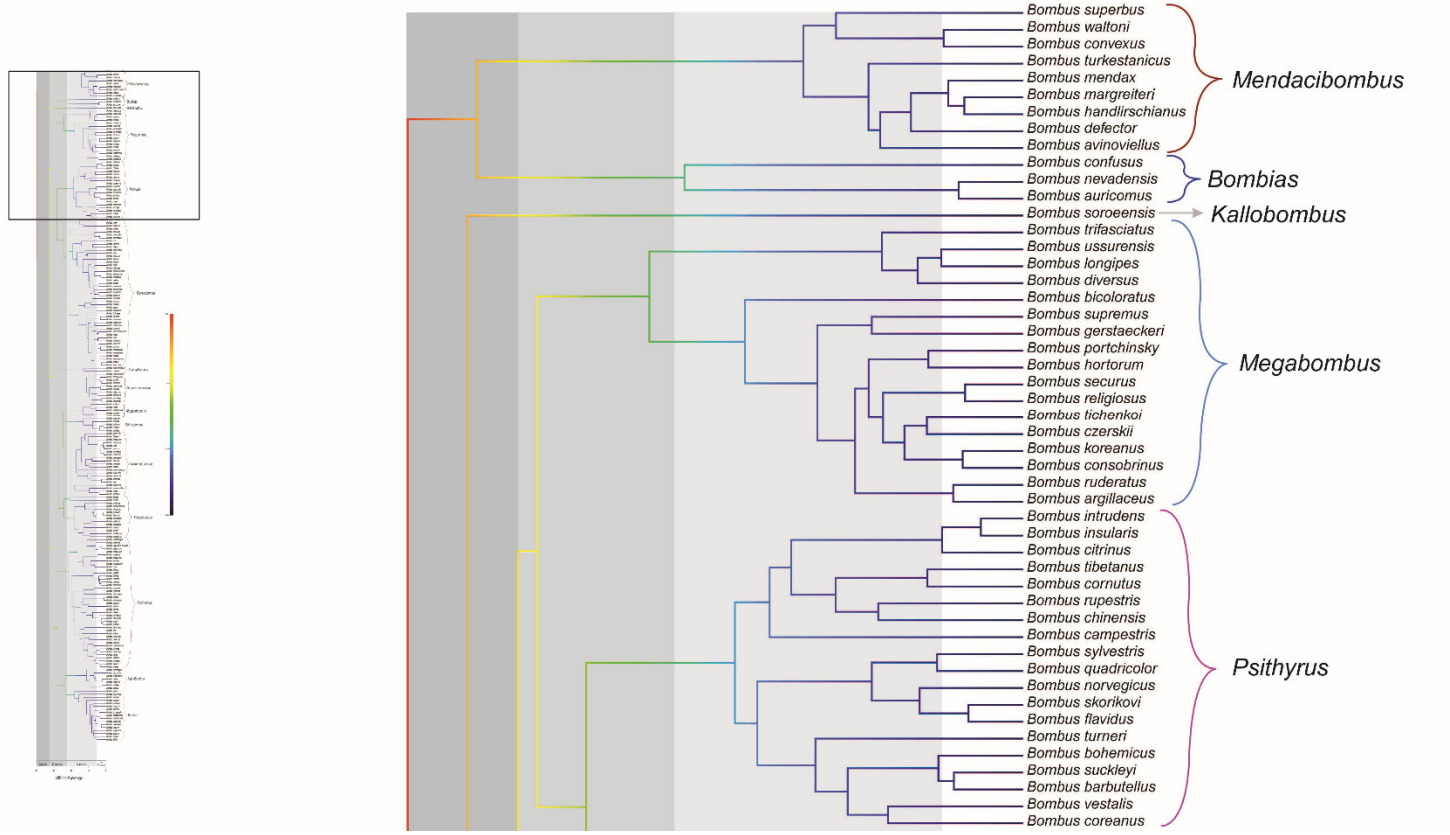
S3. Methods and results of diversification patterns

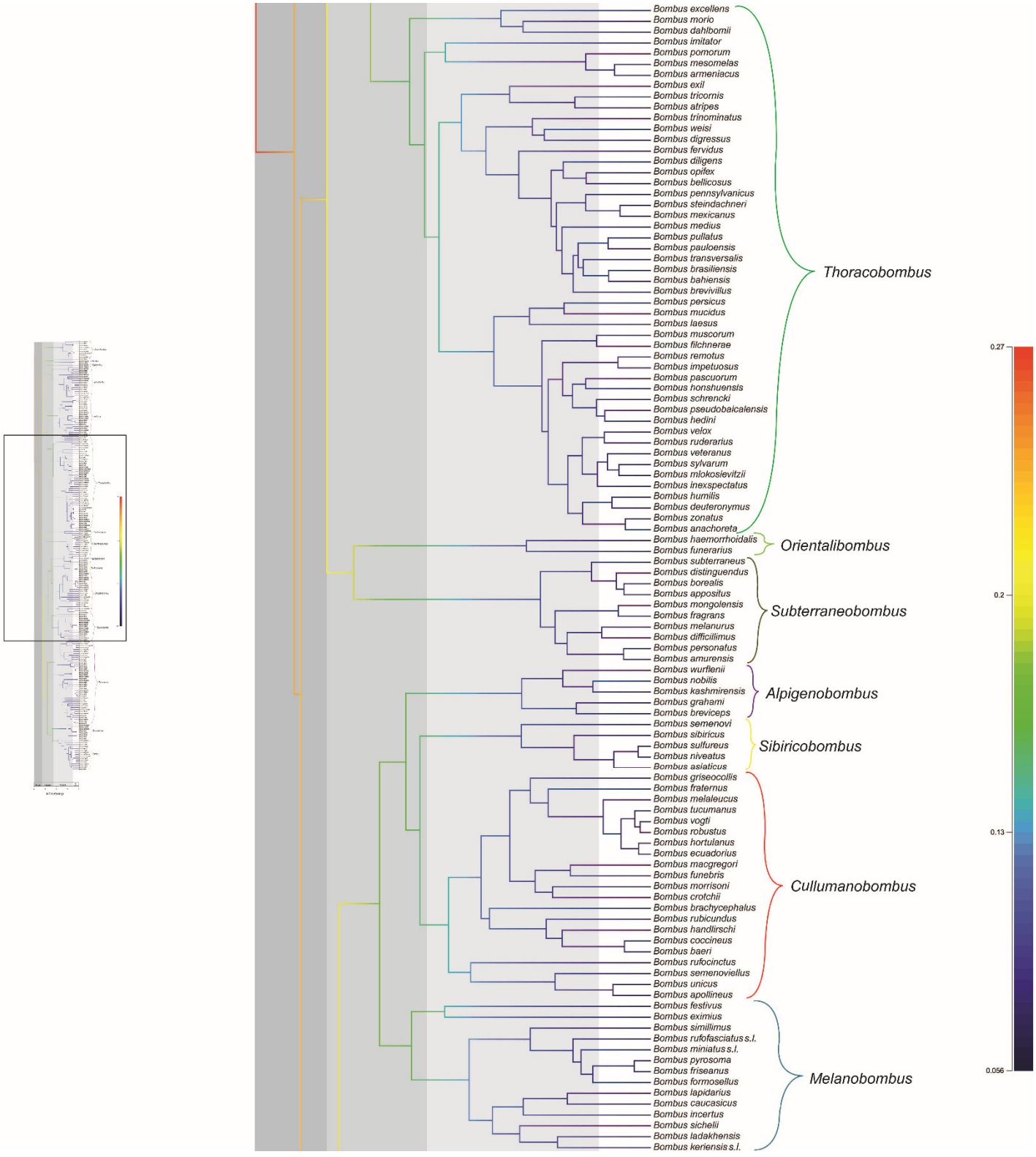
S3.1. Methods

In order to understand the diversification of bumblebee lineages through time and the variation in rates of speciation and extinction, we used Bayesian Analysis of Macroevolutionary Mixtures (BAMM, [19]). This software employs reversible jump MCMC to explore the space of models of lineage diversification, and test hypotheses about the number of divergence events responsible for a given phylogenetic pattern [19]. This is a flexible Bayesian framework for inferring the number and location of shifts in macroevolutionary rates across a dated phylogenetic tree. We used the modified MCC tree as the input phylogeny (see section Biogeographic analyses and Figure S2 for the modified MCC tree and MCC tree, respectively). Rates were inferred across the phylogeny and variation in rates of speciation and extinction of bumblebee species through time were plotted in graphs. The analyses were made with 10 million generations, with a burn-in of 20%. Priors were set by BAMMtools package in R and all output from BAMM were also processed in BAMMtools [1].

S3.2. Results

Sampling models with up to eight different evolutionary regimes were tested, however, only schemes with zero-shift models were consistently selected in the BAMM analysis (genus *Bombus*, PP = 1; Figures S11 and S12). BAMM results showed an overall decreasing pattern (Figures S11 and S12) of marginal Bayesian posterior densities of macroevolutionary rates of diversification along the time and, also, that this variation was similar across the different clades.


Bombus superbus
Bombus waltoni
Bombus convexus
Bombus turkestanicus
Bombus mendax
Bombus margreiteri
Bombus handlirschianus
Bombus defector
Bombus avinoviellus
Mendacibombus
Bombus confusus
Bombus nevadensis
Bombus auricomus
Bombias
Bombus soroeensis
Kallobombus
Bombus trifasciatus
Bombus ussurensis
Bombus longipes
Bombus diversus
Bombus bicoloratus
Bombus supremus
Bombus gerstaeckeri
Bombus portchinsky
Bombus hortorum
Bombus securus
Bombus religiosus
Bombus tichenkoi
Bombus czerskii
Bombus koreanus
Bombus consobrinus
Bombus ruderatus
Bombus argillaceus
Megabombus
Bombus intrudens
Bombus insularis
Bombus citrinus
Bombus tibetanus
Bombus cornutus
Bombus rupestris
Bombus chinensis
Bombus campestris
Bombus sylvestris
Bombus quadricolor
Bombus norvegicus
Bombus skorikovi
Bombus flavidus
Bombus turneri
Bombus bohemicus
Bombus suckleyi
Bombus barbutellus
Bombus vestalis
Bombus coreanus
Psithyrus


Bombus excellens
Bombus morio
Bombus dahlbomii
Bombus imitator
Bombus pomorum
Bombus mesomelas
Bombus armeniacus
Bombus exil
Bombus tricornis
Bombus atripes
Bombus trinominatus
Bombus weisi
Bombus digressus
Bombus fervidus
Bombus diligens
Bombus opifex
Bombus bellicosus
Bombus pennsylvanicus
Bombus steindachneri
Bombus mexicanus
Bombus medius
Bombus pullatus
Bombus pauloensis
Bombus transversalis
Bombus brasiliensis
Bombus bahiensis
Bombus brevivillus
Bombus persicus
Bombus mucidus
Bombus laesus
Bombus muscorum
Bombus filchnerae
Bombus remotus
Bombus impetuosus
Bombus pascuorum
Bombus honshuensis
Bombus schrencki
Bombus pseudobaicalensis
Bombus hedini
Bombus velox
Bombus ruderarius
Bombus veteranus
Bombus sylvarum
Bombus mlokosievitzii
Bombus inexspectatus
Bombus humilis
Bombus deuteronymus
Bombus zonatus
Bombus anachoreta
Bombus haemorrhoidalis
Bombus funerarius
Bombus subterraneus
Bombus distinguendus
Bombus borealis
Bombus appositus
Bombus mongolensis
Bombus fragrans
Bombus melanurus
Bombus difficillimus
Bombus personatus
Bombus amurensis
Bombus wurflenii
Bombus nobilis
Bombus kashmirensis
Bombus grahami
Bombus breviceps
Bombus semenovi
Bombus sibiricus
Bombus sulfureus
Bombus niveatus
Bombus asiaticus
Bombus griseocollis
Bombus fraternus
Bombus melaleucus
Bombus tucumanus
Bombus vogti
Bombus robustus
Bombus hortulanus
Bombus ecuadorius
Bombus macgregori
Bombus funebris
Bombus morrisoni
Bombus crotchii
Bombus brachycephalus
Bombus rubicundus
Bombus handlirschi
Bombus coccineus
Bombus baeri
Bombus rufocinctus
Bombus semenoviellus
Bombus unicus
Bombus apollineus
Bombus festivus
Bombus eximius
Bombus simillimus
Bombus rufofasciatus s.l.
Bombus miniatus s.l.
Bombus pyrosoma
Bombus friseanus
Bombus formosellus
Bombus lapidarius
Bombus caucasicus
Bombus incertus
Bombus sichelii
Bombus ladakhensis
Bombus keriensis s.l.
Thoracobombus
Orientalibombus
Subterraneobombus
Alpigenobombus
Sibiricobombus
Cullumanobombus
Melanobombus
0.27
0.2
0.13
0.056

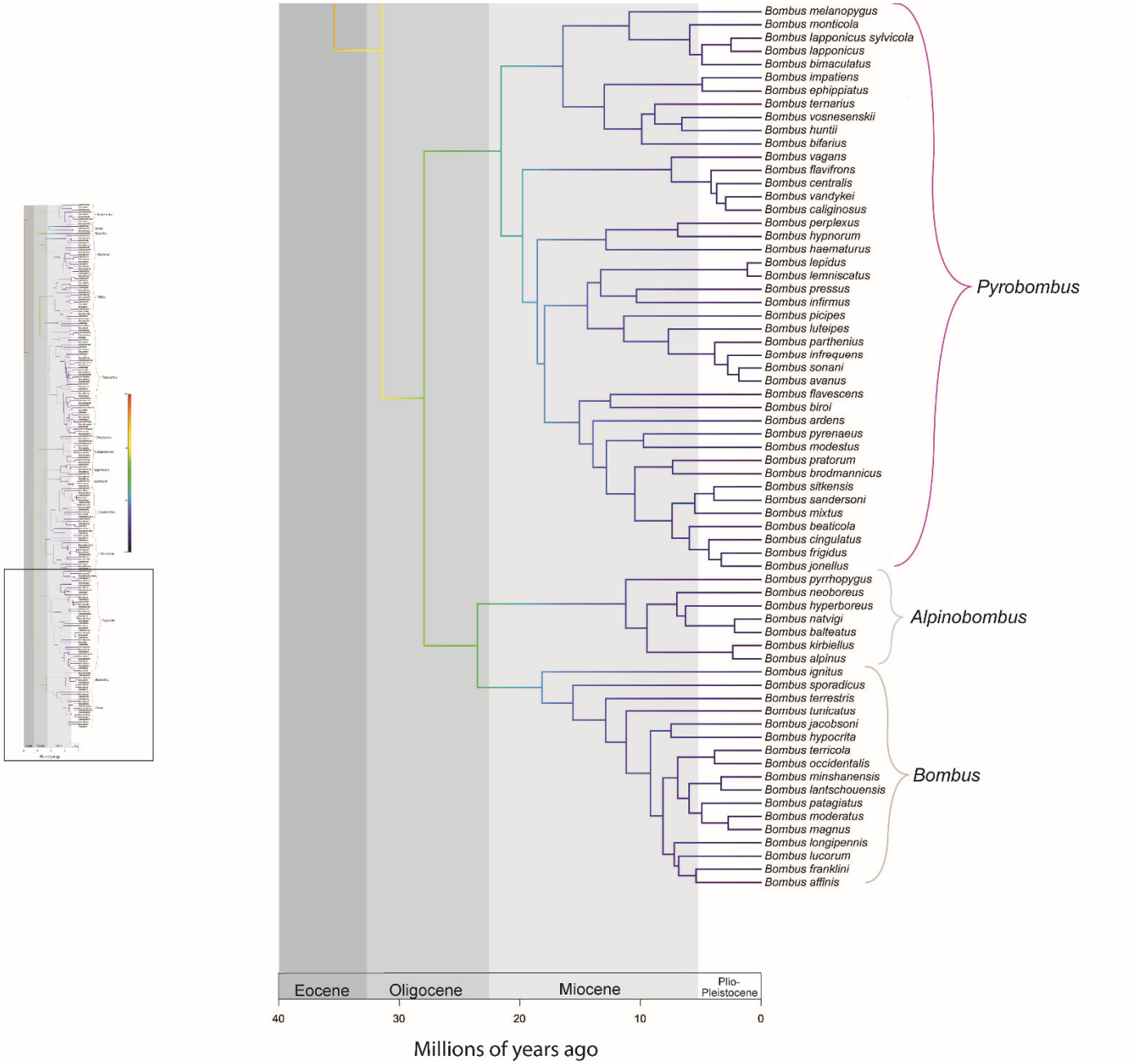


Figure S11. Bumblebee species chronogram with shading of branches reflective of estimated diversification rates (see scale at right) estimated in BAMM. Diversifications are the means of the marginal densities of the rates.

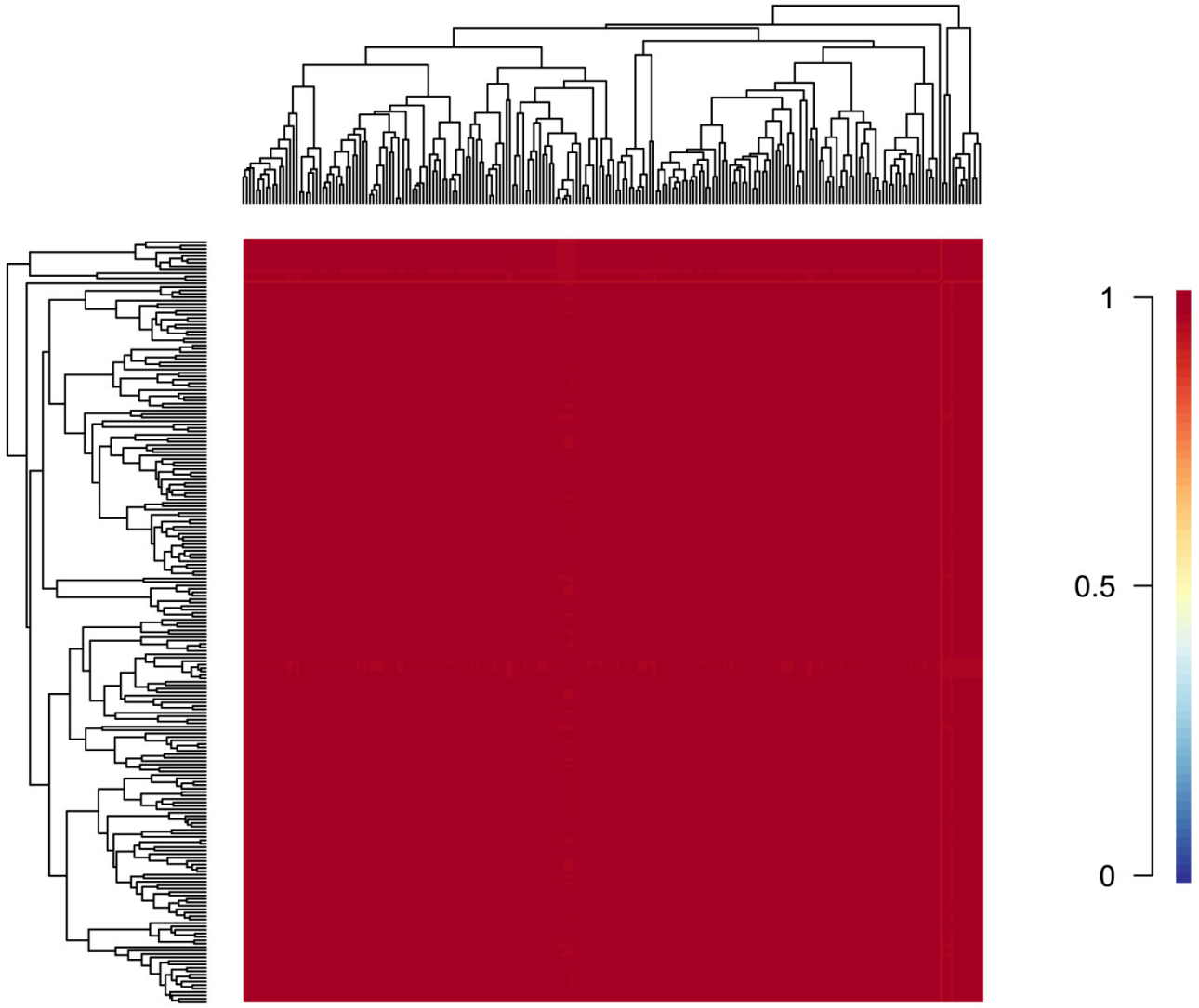


Figure S12. Macroevolutionary cohort matrix for diversification in bumblebees. Pairs of taxa with highly similar rates are depicted in hotter colors (red) and dissimilar rates are shown as colder colors (blue).

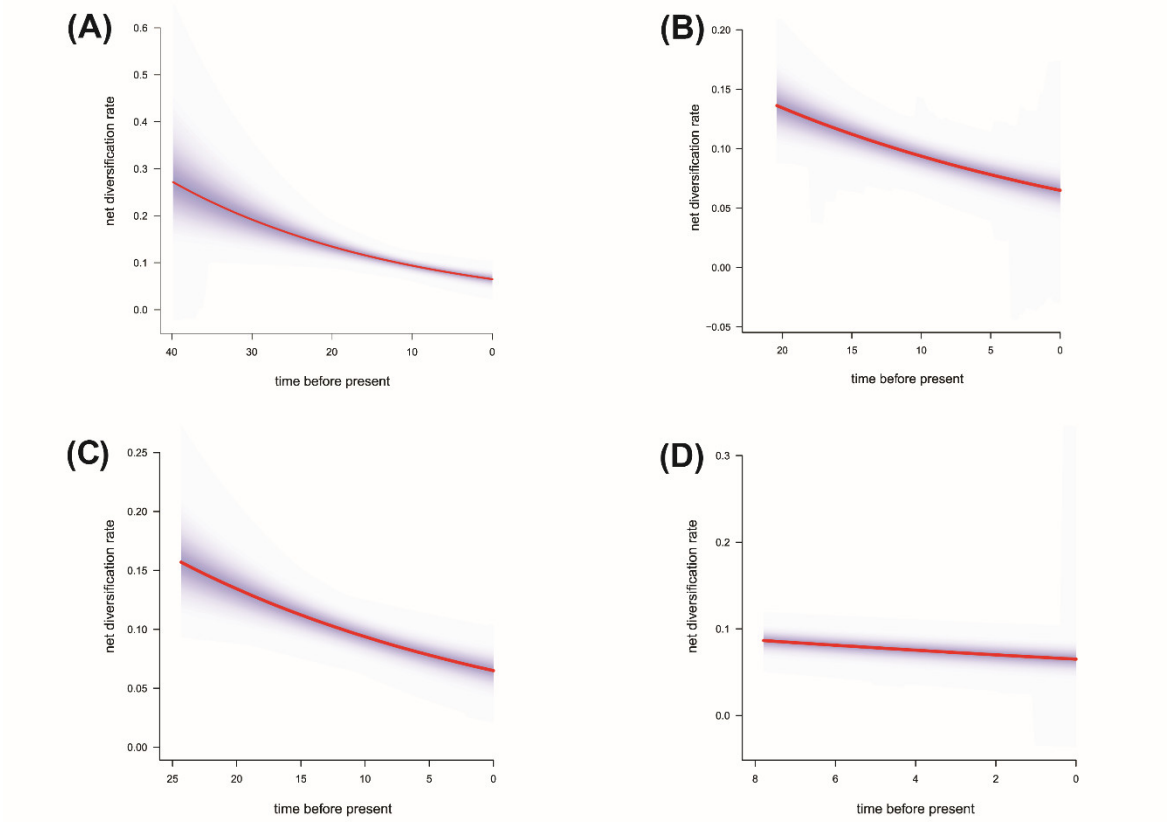


Figure S13. Estimates of speciation rate variability across the bumblebees (red line), with average global climate overlain [20]; purple line. (**A**)—All species; (**B**)—Brazilian species; (**C**)—*Cullumanobombus* and (**D**)—*Thoracobombus* subgenus.

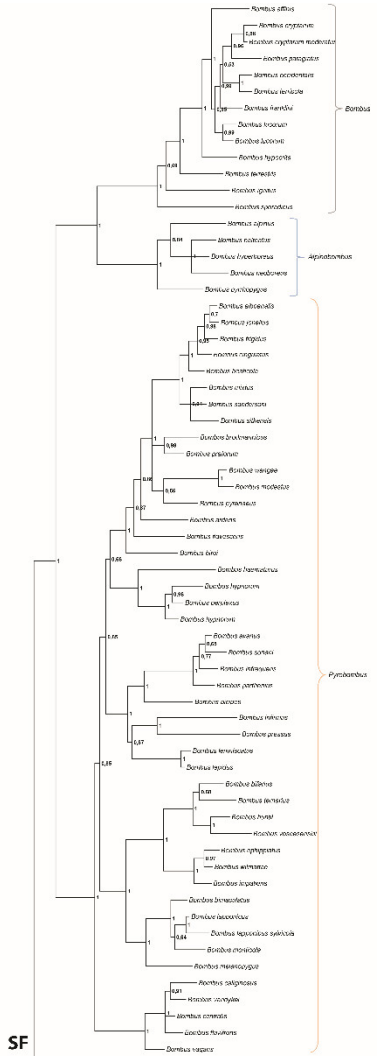
S4. Methods and results of missing data analyses

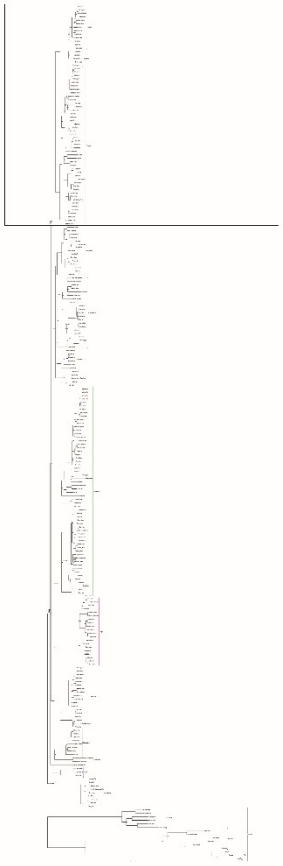
We removed 12S and CytB genes and 31 taxa (which do not share three or more genes with most of the other taxa) to assess the problem missing data in phylogenetic reconstruction and in divergence time estimates, Tables S9 and S10. While the Data set 1 has all characters for all 279 taxa (43.2% of missing data), the Data set 2 has 943,888 characters for 248 taxa (10.2% of missing data), Table S9. We analyzed Data set 2 as done for Data set 1, see sections "Phylogenetic inference" and "Divergence time estimation" in the main text for method descriptions.

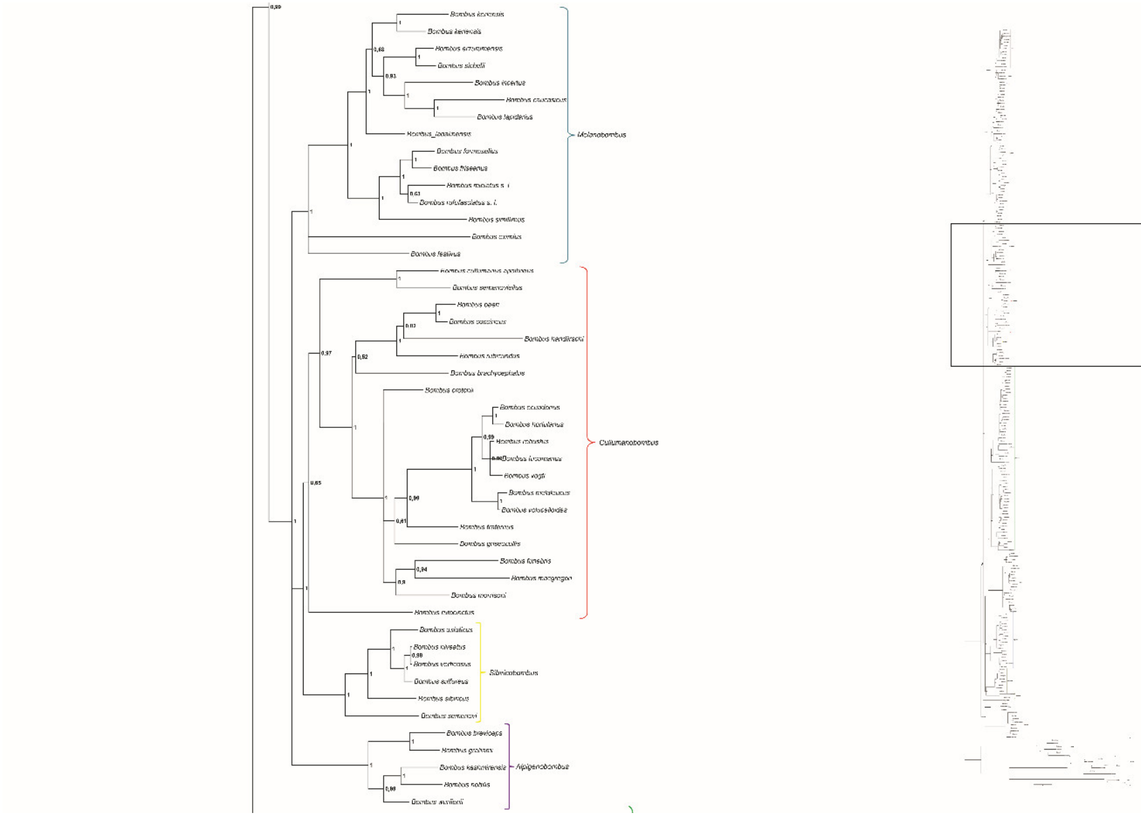
The full-length concatenated alignment data employed for phylogenetic inference had a total length of 3,805 bp (see Table S10 for specimens used and amount of missing data). Best partitioning schemes and substitution models are presented in Table S11. The topologies and divergence time estimates found in the analyses of Data set 2 were very similar to those found in the analyses of Data set 1, Figures S14 and S15. Therefore, the differences among our results and the topologies/divergence time estimates found by previous works (*i.e.* Hines [21] and Condamine & Hines [22] results) appears not to be a result of missing data bias in reconstructing trees. Our results strongly support the phylogenetic inferences about topology because informative data were analysed. Furthermore, many studies suggest that missing data are not generally problematic for Bayesian inferences and that the practice of excluding characters simply because they contain missing data may reduce accuracy [23].

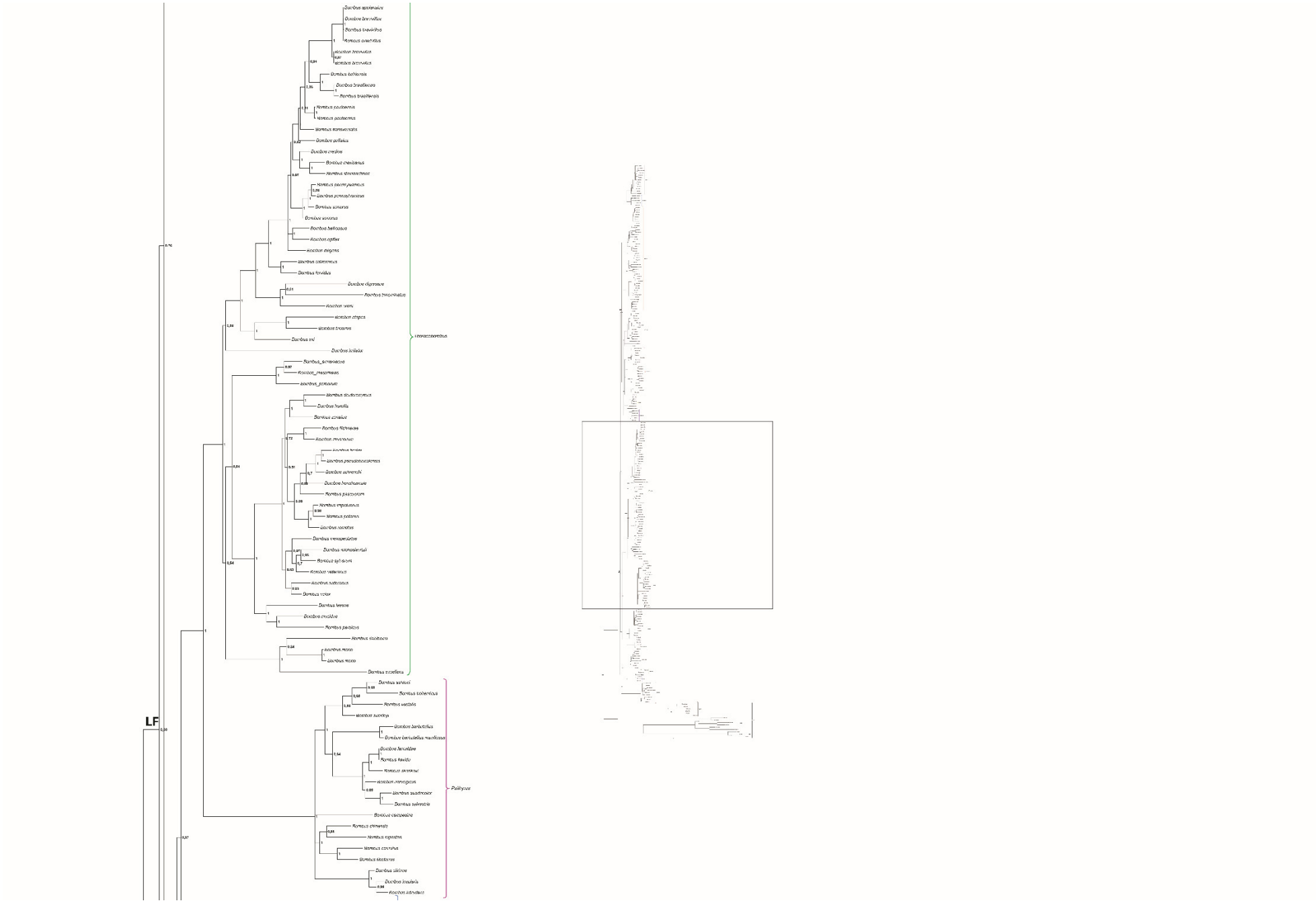
diversity

MDPI






Melanobombus
Cullumanobombus
Sibiricobombus
Alpigenobombus


LF
Palitynia

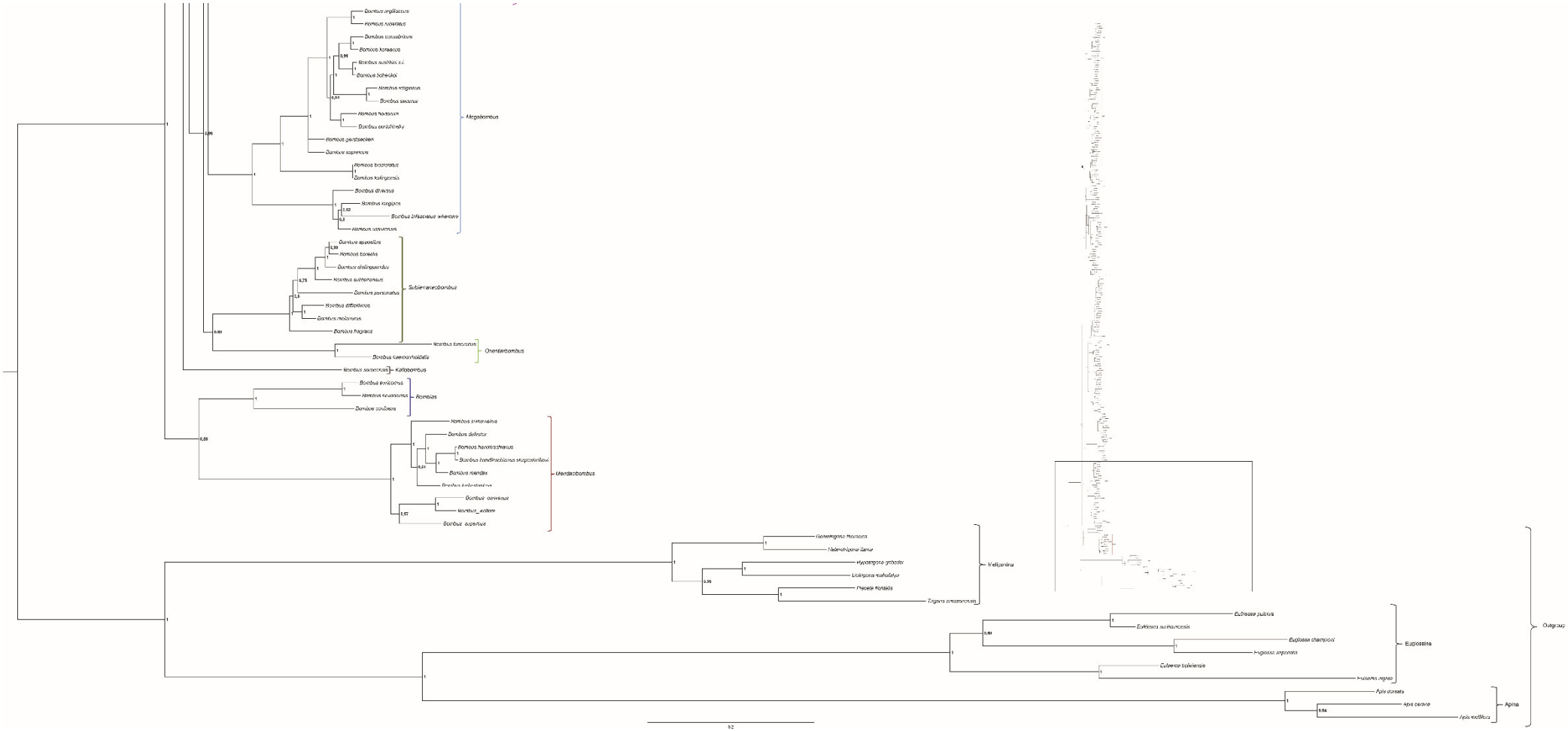
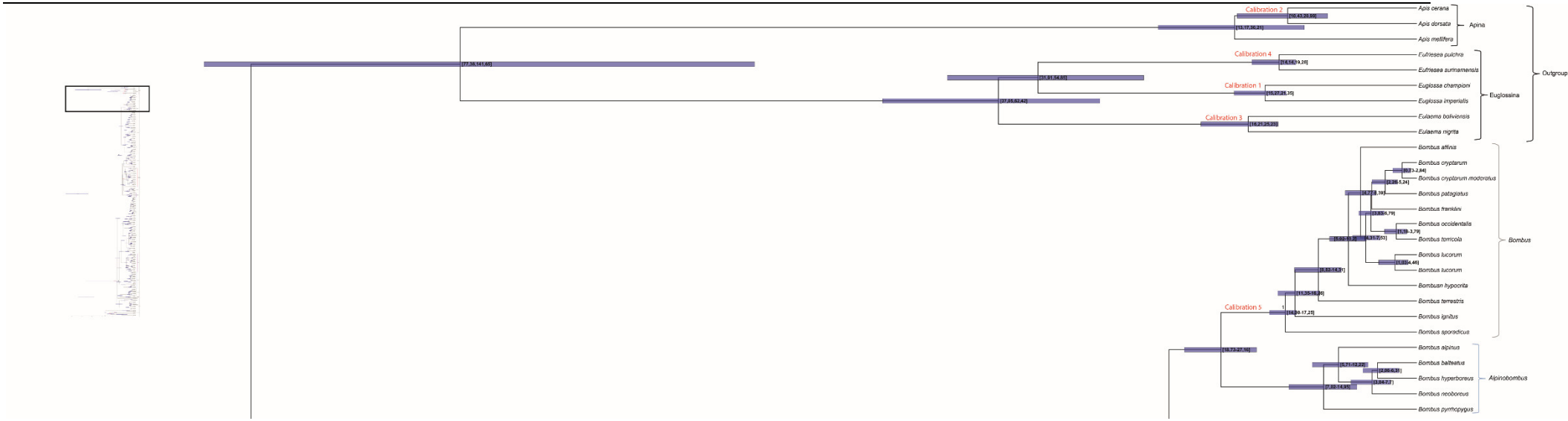
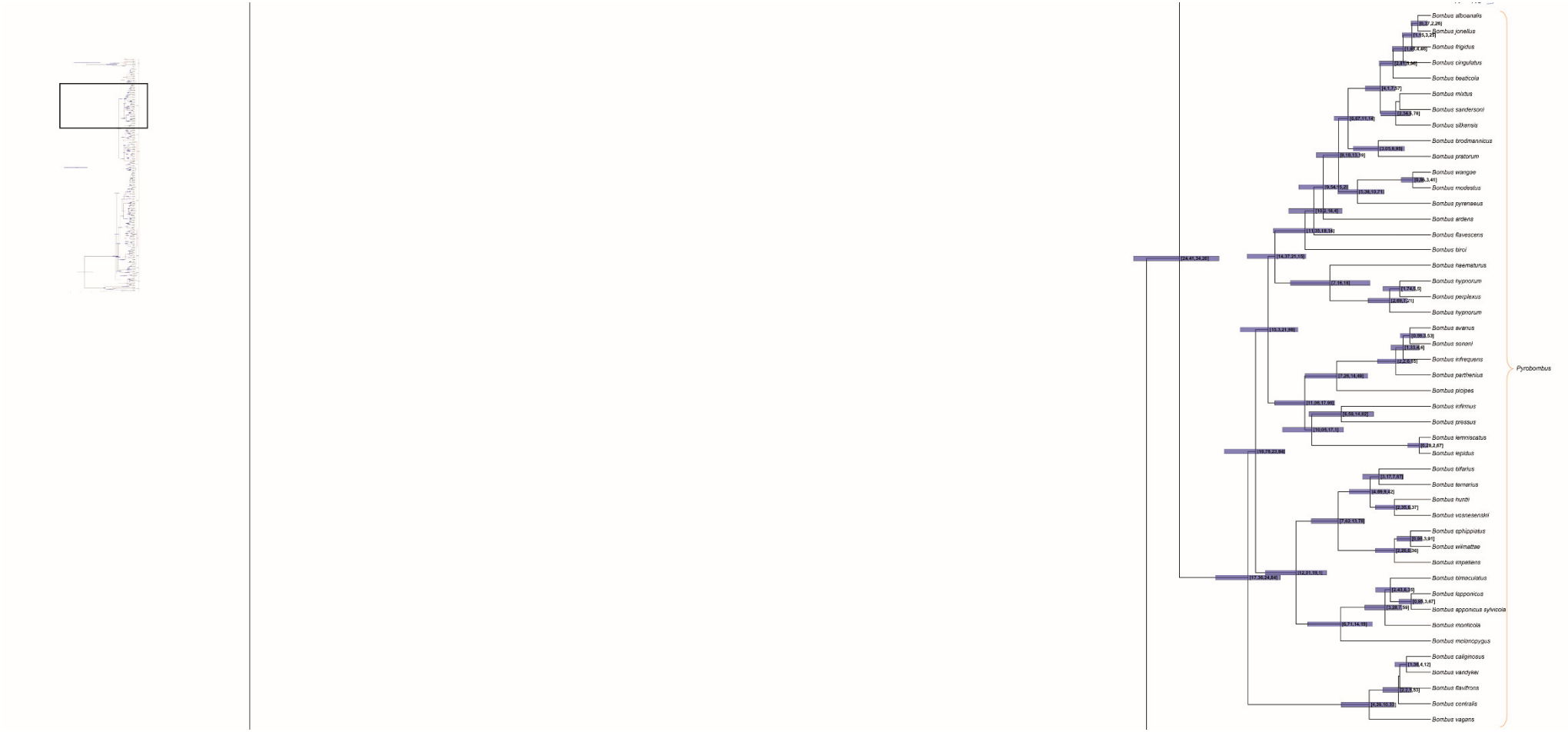


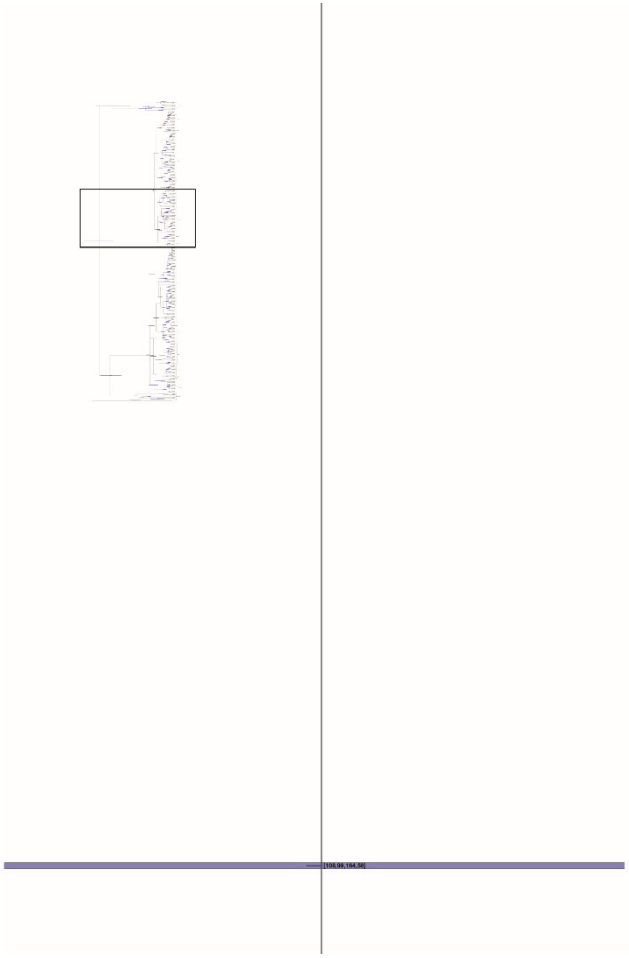
Figure S14. Phylogenetic relationships among bumblebees using Bayesian inference – BI and all species available for each subgenus. Topology recovered with the data of matrix presented in Table S10. Values shown under each branch are posterior probabilities. The standard deviation was 0.009617. Sister group of the long-faced (LF) and short-faced (SF) bumblebees were shown.

diversity

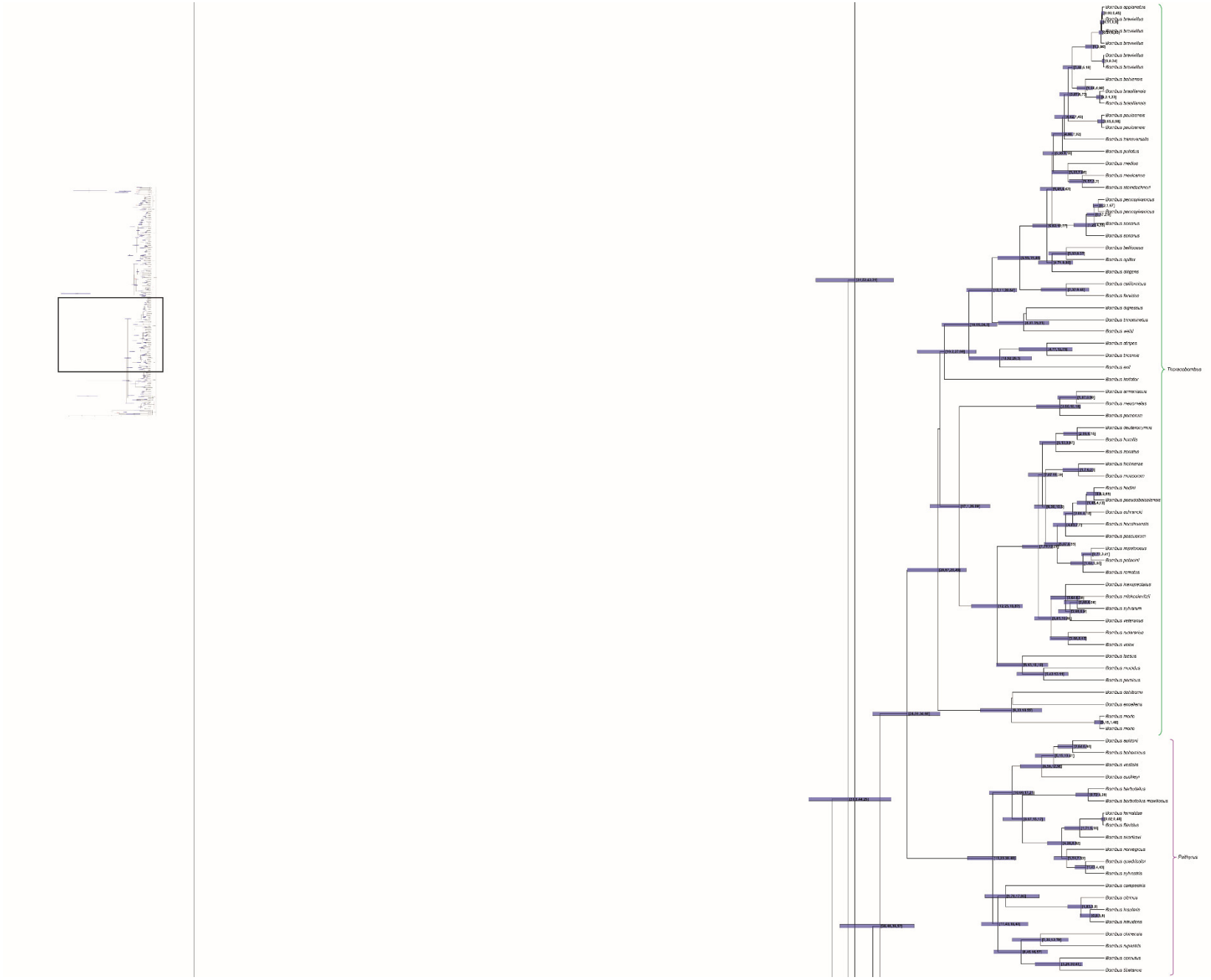
MDPI




Bombus alboanalis
Bombus jonellus
Bombus frigidus
Bombus cingulatus
Bombus balteatus
Bombus mixtus
Bombus sandersoni
Bombus silkensis
Bombus brodmannicus
Bombus pratorum
Bombus wangae
Bombus modestus
Bombus pyrenaeus
Bombus ardens
Bombus flavescens
Bombus tirol
Bombus haematurus
Bombus hypnorum
Bombus perplexus
Bombus hypnorum
Bombus avanus
Bombus soroeensis
Bombus infrequens
Bombus patagiatus
Bombus picipes
Bombus infirmus
Bombus pressus
Bombus lemniscatus
Bombus lepidus
Bombus bifarius
Bombus terricolus
Bombus huntii
Bombus vosnesenskii
Bombus ephippiatus
Bombus wilmattae
Bombus impatiens
Bombus bimaculatus
Bombus tapponicus
Bombus apponicus sylvicola
Bombus monticola
Bombus melanopygus
Bombus caliginosus
Bombus vandykei
Bombus flavifrons
Bombus centralis
Bombus vagans
Pyrobombus




SF
Bombus kerriensis
Bombus kerriensis
Bombus ladakhensis
Bombus erzurumensis
Bombus sichelii
Bombus incertus
Bombus caucasicus
Bombus lapidarius
Bombus formosellus
Bombus friscanus
Bombus minutus s. l.
Bombus rufofasciatus s. l.
Bombus similimus
Bombus eximius
Bombus festivus
Melanobombus
Bombus cullumanus apollineus
Bombus semenovellus
Bombus baeri
Bombus coccineus
Bombus handlirschi
Bombus rubicundus
Bombus brachycephalus
Bombus crotchii
Bombus griseocollis
Bombus funebris
Bombus macgregori
Bombus morrisoni
Cullumanobombus
Calibration 9
Bombus ecuadorius
Bombus hortulanus
Bombus robustus
Bombus tucumanus
Bombus vagri
Bombus melaleucus
Bombus volucelloides
Bombus fraternus
Bombus rufocinctus
Bombus asiaticus
Bombus nivatus
Bombus vorticosus
Bombus sulfureus
Bombus sibiricus
Bombus semenovi
Sibiricobombus
Bombus breviceps
Bombus grahami
Bombus kashmirensis
Bombus nobilis
Bombus wurfleini
Alpigenobombus


Tropicobambus
Pathyrostachys

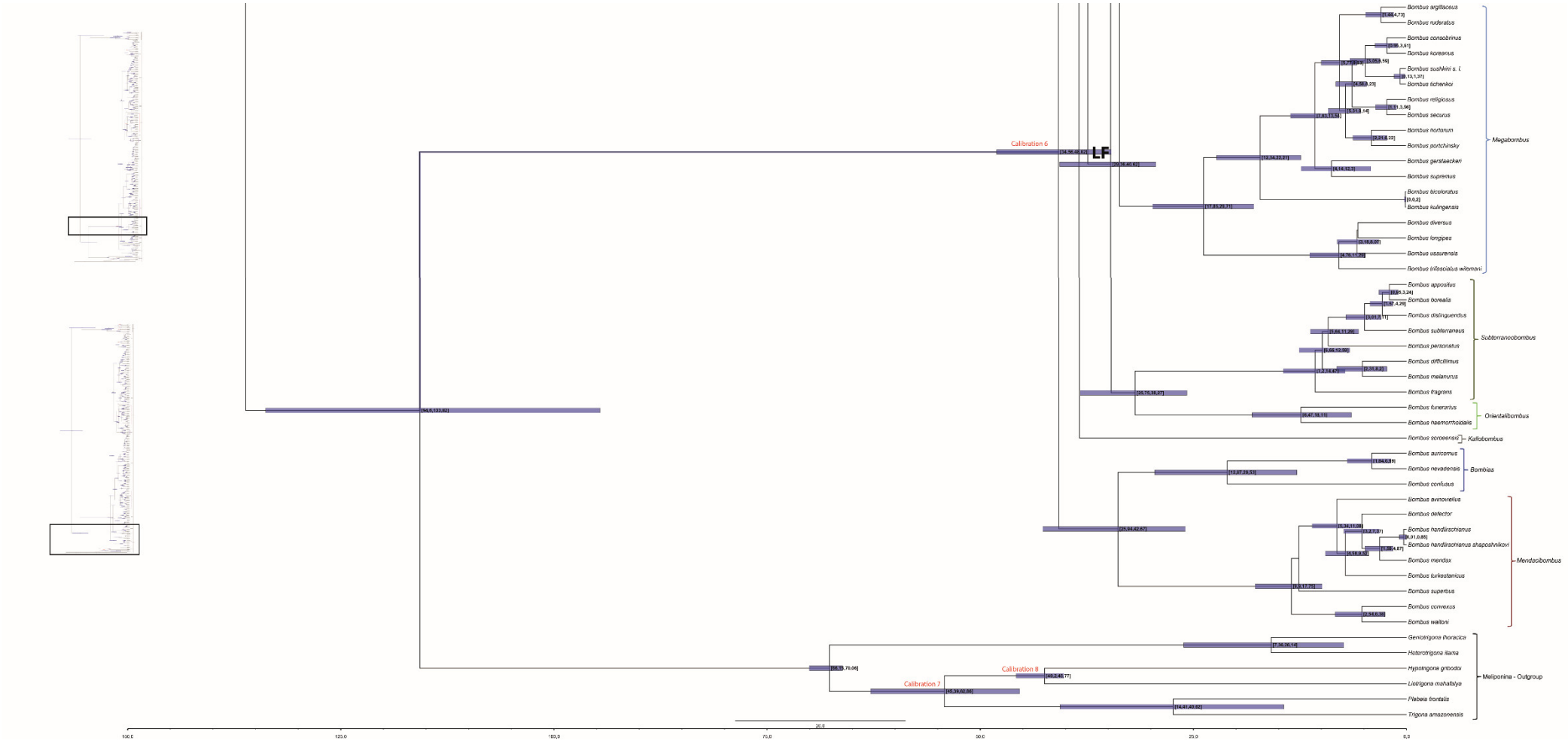


Figure S15. Estimated divergence times using Uncorrelated Lognormal Relaxed Clock model (BEAST v2.4.4). Maximum clade credibility tree depicting branch lengths equal to the median ages calculated from 9,000 post burn-in chronograms (10%). Bars show 95% Highest Posterior Density intervals of age nodes and the numbers in the brackets show dates on million years ago (Ma). Calibration points are shown above the branches in red, these refer to the fossils of Appendix B – Priors for divergence time estimation. The values shown below the tree are dates on million years. Sister group of the long-faced (LF) and short-faced (SF) bumblebees were shown.

Table S9. Basic information on the two data sets used in analyses about the impacts of missing data.

Data Set	Character Data	Number Taxa	Number Characters	Number of Missing Data Characters	Missing Data (%) Per Matrix
1	4 mitochondrial, 4 nuclear genes	279	1,726,731	746,360	43.2
2	2 mitochondrial, 4 nuclear genes	248	943,888	96,090	10.2

Table S10. Data of full-length concatenated alignment data used on phylogenetic analysis. Introns of the genes Argk, Opsin and PECK belonging to outgroup taxa and the 12S were removed of analyses. TL – Total length; N – Number of charsets; Numbers between parenthesis refer to indels and when followed by 'N' the nucleotide base is not known.

				Argk				EF1α				
Taxon	**TL (pb)**	**N**	**16S**	**Exon**	**Argk Intron**	**COI**	**EF1α Exon**	**Intron**	**Opsin Exon**	**Opsin Intron**	**PEPCK Exon**	**PEPCKI**
Apis cerana	2496	6	412 (3)	530	0	449	529	85	491	0	0	0
Apis dorsata	2795	7	384 (6)	468	0	480	529	85	501	0	348	0
Apis mellifera	2893	7	384 (4)	599	0	480	529	85	462	0	354	0
Bombus affinis voucher SC167	3805	10	441	599	248	480	529	85	501	101	381	440 (40)
Bombus alagesianus voucher SC085	3736	10	441	539	248	471	529	85	501	101	381	440
Bombus alboanalis voucher SC257	3325	9	441	599	248	0	529	85	501	101	381	440
Bombus alpinus voucher SC029	3805	10	441	599	248	480	529	85	501	101	381	440
Bombus apollineus voucher SC084	3285	9	441	599	248 (32)	0	529	85	501	101	357	424
Bombus applanatus voucher EF209	1810	5	0	488	248 (1)	480	509	85	0	0	0	0
Bombus appositus voucher SC145	3709	10	441	599	248 (1)	384	529	85	501	101	381	440 (11)
Bombus ardens voucher SC131	3736	10	441	530	248	480	529	85	501	101	381	440
Bombus argillaceus voucher SC058	3805	10	441	599	248 (1)	480	529	85	501	101	381	440
Bombus armeniacus voucher SC080	3325	9	441	599	248 (1)	0	529	85	501	101	381	440
Bombus ashtoni voucher SC164	3736	10	441	530	248 (2)	480	529	85	501	101	381	440 (37)
Bombus asiaticus voucher SC249	3167	9	441	539	248	0	529	85	501	92	381	351
Bombus atripes voucher SC066	3311	9	441	588	248 (57)	0	529	85	501	101	378	440

Taxon	TL (pb)	N	16S	Argk Exon	Argk Intron	COI	EF1α Exon	EF1α Intron	Opsin Exon	Opsin Intron	PEPCK Exon	PEPCKI
Bombus auricomus voucher SC062	3650	10	441	444	248 (49)	480	529	85	501	101 (11)	381	440 (3)
Bombus avanus voucher SC272	3264	9	441	599	248	0	529	85	501	101	357	403 (4)
Bombus avinoviellus voucher SC242	3237	9	441	539	248 (12)	0	529	85	473	101 (1 'N', 2)	381	440
Bombus baeri voucher SC174	3265	9	441	539	248 (17)	0	529	85	501	101	381	440
Bombus bahiensis 52893	3572	10	441	539	248 (1)	480	513	85	473	101	348	344 (1)
Bombus balteatus voucher SC039	3796	10	441	599	248	471	529	85	501	101	381	440
Bombus barbutellus voucher SC073	3718	10	441	599	248 (1)	393 (4 'N')	529	85	501	101	381	440 (37)
Bombus beaticola J5	2463	7	0	530	248	480	518	85	501	101	0	0
Bombus bellicosus voucher SC221	3656	10	441	539	248 (1)	419	529	85	473	101 (1 'N', 2)	381	440
Bombus bicoloratus voucher SC225	3639	10	441	530	248 (1)	480	529	85	501	101	348	376
Bombus bifarius voucher SC208	3460	10	441	530	248 (78)	204	529	85	501	101	381	440
Bombus bimaculatus voucher SC218	3805	10	441	599	248 (78)	480	529	85	501	101	381	440
Bombus biroi voucher SC210	3265	9	441	539	248	0	529	85	501	101	381	440
Bombus bohemicus voucher SC055	3649	10	441	530	248 (2)	393 (4 'N')	529	85	501	101	381	440 (37)
Bombus borealis voucher SC250	3688	10	441	530	248 (1)	480	529	85	501	101	351	422 (11)
Bombus brachycephalus voucher SC230	3325	9	441	599	248 (17)	0	529	85	501	101	381	440
Bombus brasiliensis 1218400	3585	10	441	539	248 (1)	480	529	85	473	101	348	341 (1)
Bombus brasiliensis voucher SC219	2796	8	441	0	0	435	529	85	473 (3 'N')	101 (7 'N', 2)	381	351
Bombus breviceps voucher SC190	3739	10	441	599	248	414	529	85	501	101	381	440
Bombus brevivillus 1200916	3412	10	441	414	248 (1)	435	521	85	473	101	348	346 (1)
Bombus brevivillus 1202754	3501	10	441	508	248 (1)	435	520	85	473	101	348	342 (1)
Bombus brevivillus 1207210	3407	10	441	414	248 (1)	461	497	85	473	101	348	339 (1)
Bombus brevivillus 1207320	3324	10	441	414	248 (1)	466	529	85	473	101	348	219
Bombus brevivillus 1207321	3444	10	441	414	248 (1)	466	529	85	473	101	348	339 (1)
Bombus brodmannicus voucher SC077	3773	10	441	599	248	448	529	85	501	101	381	440
Bombus californicus voucher SC306	3297	9	441	599	248 (1)	0	529	85	473	101 (2)	381	440

Taxon	TL (pb)	N	16S	Argk Exon	Argk Intron	COI	EF1α Exon	EF1α Intron	Opsin Exon	Opsin Intron	PEPCK Exon	PEPCKI
Bombus caliginosus voucher SC150	3256	9	441	530	248	0	529	85	501	101	381	440
Bombus campestris voucher SC040	3727	10	441	530	248 (2)	480	520	85	501	101	381	440 (37)
Bombus centralis voucher SC146	3691	10	441	599	248	366	529	85	501	101	381	440
Bombus chinensis voucher SC152	3325	9	441	599	248 (1)	0	529	85	501	101	381	440 (37)
Bombus cingulatus voucher SC212	3647	10	441	530	248	480	529	85	501	101	381	351
*Bombus citrinu*s voucher SC170	3736	10	441	530	248 (53)	480	529	85	501	101	381	440 (37)
Bombus coccineus voucher SC137	3325	9	441	599	248 (17)	0	529	85	501	101	381	440
Bombus confusus voucher SC083	3805	10	441	599	248 (173)	480	529	85	501	101	381	440
Bombus consobrinus voucher SC261	3736	10	441	530	248 (1)	480	529	85	501	101	381	440
Bombus convexus voucher SC109	3189	9	441	539	248 (12)	0	529	85	501	101	348	397
Bombus cornutus voucher SC271	2930	9	441	539	248 (1)	0	529	85	234	33	381	440 (37)
Bombus crotchii voucher SC071	3256	9	441	530	248 (17)	0	529	85	501	101	381	440
Bombus cryptarum voucher SC127	3805	10	441	599	248	480	529	85	501	101	381	440 (40)
Bombus dahlbomii voucher SC016	3460	10	441	530	248 (1)	204	529	85	501	101	381	440
Bombus defector J3	3729	10	441	530	248 (12)	480	529	85	501	101	381	433
Bombus deuteronymus voucher SC147	3655	10	441	530	248 (3)	480	529	83	501	101	381	361 (4)
Bombus difficillimus voucher SC154	3325	9	441	599	248 (1)	0	529	85	501	101	381	440
Bombus digressus voucher SC307	3148	9	441	539	248 (26)	0	529	85	473	101 (4 'N', 2)	381	351 (1)
Bombus diligens voucher SC171	3777	10	441	599	248 (24)	480	529	85	473	101 (1 'N', 2)	381	440
Bombus distinguendus voucher SC197	3748	10	441	599	248 (11)	423	529	85	501	101	381	440 (11)
Bombus diversus voucher SC120	3736	10	441 (2)	530	248 (1)	480	529	85	501	101	381	440
Bombus ecuadorius voucher SC135	3325	9	441	599	248 (17)	0	529	85	501	101	381	440 (5)
Bombus ephippiatus voucher SC198	3649	10	441 (1)	599	248 (78)	324	529	85	501	101	381	440
Bombus erzurumensis voucher SC126	3796	10	441	599	248	471	529	85	501	101	381	440
Bombus excellens voucher SC308	3717	10	441	539	248 (1)	480	529	85	473	101 (2)	381	440
Bombus exil voucher SC232	3245	9	441	539	248 (49)	0	529	85	501	101	361	440

Taxon	TL (pb)	N	16S	Argk Exon	Argk Intron	COI	EF1α Exon	EF1α Intron	Opsin Exon	Opsin Intron	PEPCK Exon	PEPCKI
Bombus eximius voucher SC049	3805	10	441	599	248	480	529	85	501	101	381	440
Bombus fernaldae voucher SC088	3733	10	441	530	248 (2)	477	529	85	501	101	381	440 (37)
Bombus fervidus voucher SC309	3736	10	441	530	248 (1 'N', 1)	480	529	85	501	101	381	440
Bombus festivus voucher SC104	3325	9	441 (1)	599	248	0	529	85	501	101	381	440
Bombus filchnerae voucher SC206	3325	9	441	599	248 (1)	0	529	85	501	101	381	440 (4)
Bombus flavescens voucher SC181	3736	10	441	530	248	480	529	85	501	101	381	440
Bombus flavidus voucher SC041	3796	10	441	599	248 (2)	471	529	85	501	101	381	440 (37)
Bombus flavifrons voucher SC095	3736	10	441	530	248	480	529	85	501	101	381	440
Bombus formosellus J2	2474	7	0	530	248	480	529	85	501	101	0	0
Bombus fragrans voucher SC061	3325	9	441	599	248 (1)	0	529	85	501	101	381	440
Bombus franklini voucher SC256	3781	10	417	599	248	480	529	85	501	101	381	440 (40)
Bombus fraternus voucher SC183	3736	10	441 (1)	530	248 (17)	480	529	85	501	101	381	440
Bombus frigidus voucher SC185	3803	10	441	597 (2 'N')	248	480	529	85	501	101	381	440
Bombus friseanus voucher SC105	3325	9	441	599	248	0	529	85	501	101	381	440
Bombus funebris voucher SC128	3795	10	431	599	248 (17)	480 (30 'N')	529	85	501	101	381	440 (1)
Bombus funerarius voucher SC270	3744	10	441	599	248 (1)	419	529	85	501	101	381	440 (13)
Bombus gerstaeckeri voucher SC065	3802	10	441	599	248 (1)	477	529	85	501	101	381	440
Bombus grahami voucher SC273	3499	10	441	519	248	372	529	85	501	101	348	355 (4 'N')
Bombus griseocollis voucher SC082	3256	9	441	530	248 (17)	0	529	85	501	101	381	440
Bombus haematurus voucher SC211	1373	5	441	0	0	0	529	85	0	0	201	117
Bombus haemorrhoidalis voucher SC191	3697	10	441	491	248 (1 'N', 1)	480	529	85	501	101	381	440
Bombus handlirschi voucher SC132	3211	9	441	539	248 (17)	0	529	85	501	101	351	416 (4)
Bombus handlirschianus voucher SC087	3265	9	441	539	248 (16)	0	529	85	501	101	381	440
Bombus hedini voucher SC129	3325	9	441	599	248 (6)	0	529	85	501	101	381	440 (4)
Bombus honshuensis J7	2474	7	0	530	248 (6)	480	529	85	501	101	0	0

Taxon	TL (pb)	N	16S	Argk Exon	Argk Intron	COI	EF1α Exon	EF1α Intron	Opsin Exon	Opsin Intron	PEPCK Exon	PEPCKI
Bombus hortorum voucher SC005	3736	10	441	530	248 (1)	480	529	85	501	101	381	440
Bombus hortulanus voucher SC200	3325	9	441	599	248 (17)	0	529	85	501	101	381	440 (5)
Bombus humilis voucher SC056	3724	10	441	599	248 (3)	480	529	83	501	101	381	361 (4)
Bombus huntii voucher SC151	3580	10	441	530	248 (78)	324	529	85	501	101	381	440
Bombus hyperboreus voucher SC070	3796	10	441	599	248 (6)	471	529	85	501	101	381	440
Bombus hypnorum voucher SC078	3701	10	441	530	248	471	529	85	501	101	355	440
Bombus hypnorum voucher SC207	3796	10	432	599	248	480	529	85	501	101	381	440
Bombus hypocrita voucher SC123	3736	10	441	530	248	480	529	85	501	101	381	440 (40)
Bombus ignitus voucher SC096	3736	10	441	530	248	480	529	85	501	101	381	440 (49)
Bombus imitator voucher SC028	3325	9	441	599	248 (1)	0	529	85	501	101	381	440 (30)
Bombus impatiens voucher SC060	3714	10	441	530	248 (78)	480	529	85	501	101	359	440
Bombus impetuosus voucher SC284	3304	9	441	578	248 (6)	0	529	85	501	101	381	440 (46)
Bombus incertus voucher SC086	3736	10	441	539	248	471	529	85	501	101	381	440
Bombus inexspectatus B05	3042	9	411	509	248 (1)	0	529	85	459	101	348	352 (46)
Bombus infirmus voucher SC157	3315	9	441	599	248 (26)	0	529	85	501	101	381	430
Bombus infrequens voucher SC140	3325	9	441	599	248	0	529	85	501	101	381	440
Bombus insularis voucher SC162	3736	10	441	530	248 (53)	480 (1 'N')	529	85	501	101	381	440 (37)
Bombus jonellus voucher SC079	3805	10	441	599	248	480	529	85	501	101	381	440
Bombus kashmirensis voucher SC121	3324	9	441	598	248	0	529	85	501	101	381	440
Bombus keriensis voucher SC114	3325	9	441	599	248	0	529	85	501	101	381	440
Bombus koreanus voucher SC277	3736	10	441	530	248 (1)	480	529	85	501	101	381	440
Bombus kulingensis voucher SC097	3691	10	441	539	248 (1)	434	521	85	501	101	381	440
Bombus ladakhensis voucher SC158	3319	9	441	599	248	0	523	85	501	101	381	440
Bombus laesus voucher SC052	3792	10	441	599	248 (1)	480	529	85	501	101	369	439 (77)
Bombus lapidarius caucasicus voucher L084TR	2508	7	0	0	0	471	529	85	501	101	381	440
Bombus lapidarius voucher SC006	3736	10	441	530	248	480	529	85	501	101	381	440

Taxon	TL (pb)	N	16S	Argk Exon	Argk Intron	COI	EF1α Exon	EF1α Intron	Opsin Exon	Opsin Intron	PEPCK Exon	PEPCKI
Bombus lapponicus voucher SC103	3804	10	441	599	248 (78)	480	528	85	501	101	381	440
Bombus lemniscatus voucher SC161	3288	9	441	599	248 (22)	0	529	85	501	101	358	426
Bombus lepidus voucher SC155	3325	9	441	599	248 (22)	0	529	85	501	101	381	440
Bombus longipes voucher SC194	3805	10	441 (2)	599	248 (1)	480	529	85	501	101	381	440 (6)
Bombus lucorum voucher SC184	3805	10	441	599	248	480	529	85	501	101	381	440 (40)
Bombus lucorum voucher SC217	3729	10	441	530	248	473	529	85	501	101	381	440 (40)
Bombus macgregori voucher SC231	3325	9	441	599	248 (17)	0	529	85	501	101	381	440
Bombus maxillosus voucher SC074	3325	9	441	599	248 (1)	0	529	85	501	101	381	440 (37)
Bombus medius voucher SC222	3717	10	441	539	248 (6)	480 (24 'N')	529	85	473	101 (3 'N', 2)	381	440
Bombus melaleucus voucher SC173	3265	9	441	539	248 (18)	0	529	85	501	101	381	440 (5)
Bombus melanopygus voucher SC215	3736	10	441	530	248 (78)	480	529	85	501	101	381	440
Bombus melanurus voucher SC022	3647	10	441	530	248 (1)	480	529	85	501	101	381	351
Bombus mendax voucher SC019	3730	10	441	530	248 (12)	480	523	85	501	101	381	440
Bombus mesomelas voucher SC037	3805	10	441	599	248 (1)	480	529	85	501	101	381	440
Bombus mexicanus voucher SC220	3432	10	441	527	248 (6)	207	529	85	473	101 (3 'N', 2)	381	440
Bombus miniatus voucher SC244	3265	9	441	539	248	0	529	85	501	101	381	440
Bombus mixtus voucher SC024	3715	10	441	530	248	459	529	85	501	101	381	440
Bombus mlokosievitzii voucher SC081	3325	9	441	599	248 (1)	0	529	85	501	101	381	440 (46)
Bombus moderatus voucher SC163	3805	10	441	599	248	480 (1 'N')	529	85	501	101	381	440 (40)
Bombus modestus voucher SC160	3805	10	441	599	248	480	529	85	501	101	381	440
Bombus modestus voucher SC238	3805	10	441 (1)	599	248	480	529	85	501	101	381	440
Bombus monticola voucher SC176	3805	10	441	599	248 (78)	480	529	85	501	101	381	440
Bombus morio B13	3548	10	441	537	248 (1)	435	529	85	473	101	348	351 (1)
Bombus morio voucher SC310	3732	10	441	599	248 (1)	435	529	85	473 (1 'N')	101 (2)	381	440
Bombus morrisoni voucher SC196	3325	9	441	599	248 (17)	0	529	85	501	101	381	440

Taxon	TL (pb)	N	16S	Argk Exon	Argk Intron	COI	EF1α Exon	EF1α Intron	Opsin Exon	Opsin Intron	PEPCK Exon	PEPCKI
Bombus mucidus voucher SC059	3641	10	441	530	248 (1)	395	519	85	501	101	381	440 (4)
Bombus muscorum voucher SC033	3796	10	441	599	248 (1)	471	529	85	501	101	381	440 (4)
Bombus neoboreus voucher SC188	3325	9	441	599	248 (6)	0	529	85	501	101	381	440
Bombus nevadensis voucher SC139	3324	10	441	428	248	204	529	85	501	101 (11)	357	430 (6)
Bombus niveatus voucher SC093	3224	9	441	599	248	0	529	84	501	90	381	351
Bombus nobilis voucher SC098	3325	9	441	599	248	0	529	85	501	101	381	440
Bombus norvegicus voucher SC089	3778	10	441	599	248 (2)	453	529	85	501	101	381	440 (37)
Bombus oberti voucher SC234	3316	9	441	599	248	0	529	85	501	92	381	440 (2)
Bombus occidentalis voucher SC026	3778	10	441	599	248	453	529	85	501	101	381	440 (40)
*Bombus opifex v*oucher SC175	3805	10	441	599	248 (1)	480	529	85	501	101	381	440
Bombus parthenius voucher SC241	3265	9	441	539	248	0	529	85	501	101	381	440
Bombus pascuorum voucher SC023	3736	10	441	530	248 (5)	480	529	85	501	101	381	440 (4)
Bombus patagiatus voucher SC111	3736	10	441	530	248	480	529	85	501	101	381	440 (40)
Bombus pauloensis 77202	2767	8	441	0	0	448	529	85	473	101	348	342 (1)
Bombus pauloensis voucher SC305	3670	10	441	539	248 (6)	435	527	85	473	101 (1 'N', 2)	381	440
Bombus pennsylvanicus voucher SC311	3322	9	441	599	248 (1)	0	529	85	501	101	381	437
*Bombus pennsylvanic*us voucher SC317	3805	10	441	599	248 (1)	480	529	85	501	101	381	440
Bombus perplexus voucher SC166	3736	10	441	530	248	480	529	85	501	101	381	440
Bombus persicus voucher SC054	3273	9	441	573	248 (15)	0	527	85	501	101	359	438
Bombus personatus voucher SC138	3325	9	441	599	248 (1)	0	529	85	501	101	381	440
Bombus picipes voucher SC180	3325	9	441	599	248	0	529	85	501	101	381	440
Bombus polaris voucher SC223	3638	10	441	530	248	471	529	85	501	101	381	351
Bombus pomorum voucher SC053	3325	9	441	599	248 (1)	0	529	85	501	101	381	440
Bombus portchinsky voucher SC072	3767	10	441	599	248 (1)	480	529	85	501	101	353	430 (12 'N')
Bombus potanini voucher SC113	3317	9	441	599	248 (6)	0	521	85	501	101	381	440 (46)
Bombus pratorum voucher SC075	3686	10	441	530	248	480	529	85	501	101	351	420

Taxon	TL (pb)	N	16S	Argk Exon	Argk Intron	COI	EF1α Exon	EF1α Intron	Opsin Exon	Opsin Intron	PEPCK Exon	PEPCKI
Bombus pressus voucher SC239	1365	5	441	0	0	0	529	85	0	0	201	109
Bombus pseudobaicalensis voucher SC253	3736	10	441	530 (2 'N')	248 (6)	480	529	85	501	101	381	440 (4)
Bombus pullatus voucher SC312	3501	10	441	599	248 (1)	204	529	85	473 (1 'N')	101 (3 'N', 2)	381	440
Bombus pyrenaeus voucher SC035	3805	10	441	599	248	480	529	85	501	101	381	440
Bombus quadricolor voucher SC090	3805	10	441	599	248 (2)	480	529	85	501	101	381	440 (37)
Bombus religiosus voucher SC141	3600	10	441	599	248 (1)	480	529	85	296	101	381	440
Bombus remotus voucher SC192	3325	9	441	599	248 (6)	0	529	85	501	101	381	440 (46)
Bombus robustus voucher SC050	3469	10	441	539	248 (17)	204	529	85	501	101	381	440 (5)
Bombus rubicundus voucher SC202	3325	9	441	599	248 (17)	0	529	85	501	101 (2)	381	440
Bombus ruderarius voucher SC047	3726	10	441	530	248 (1)	480	519	85	501	101	381	440 (46)
Bombus ruderatus voucher SC018	3736	10	441	530	248 (1)	480	529	85	501	101	381	440
Bombus rufocinctus voucher SC186	3705	10	441	530	248 (8)	449	529	85	501	101 (1)	381	440
Bombus rufofasciatus voucher SC133	3296	9	441	599	248	0	529	85	501	101	352	440
Bombus rupestris voucher SC009	3736	10	441	530	248 (1)	480	529	85	501	101	381	440 (37)
Bombus sandersoni voucher SC255	3782	10	418	599	248	480 (4 'N')	529	85	501	101	381	440
Bombus schrencki voucher SC298	3691	10	412	530	248 (6)	480	513	85	501	101	381	440 (4)
Bombus securus voucher SC142	3805	10	441	599	248 (1)	480	529	85	501	101	381	440
Bombus semenoviellus voucher SC236	3805	10	441	599	248 (32)	480	529	85	501	101	381	440
Bombus shaposhnikovi voucher SC099	3265	9	441	539	248 (16)	0	529	85	501	101	381	440
Bombus sibiricus voucher SC274	3705	10	441	599	248	480	529	85	501	90	381	351
Bombus sichelii voucher SC034	3420	10	441	599	248	480	529	85	196	21	381	440
Bombus simillimus voucher SC243	3324	9	441	599	248	0	529	85	501	101	380	440
Bombus sitkensis voucher SC144	3325	9	441	599	248 (7)	0	529	85	501	101	381	440
Bombus skorikovi voucher SC159	3325	9	441	599	248 (2)	0	529	85	501	101	381	440 (37)
Bombus sonani J6	2474	7	0	530	248	480	529	85	501	101	0	0
Bombus sonorus voucher SC051	3315	9	431	599	248 (1)	0	529	85	501	101	381	440

Taxon	TL (pb)	N	16S	Argk Exon	Argk Intron	COI	EF1α Exon	EF1α Intron	Opsin Exon	Opsin Intron	PEPCK Exon	PEPCKI
Bombus sonorus voucher SC318	3297	9	441 (1)	599	248 (1)	0	529	85	473	101 (1 'N', 2)	381	440
Bombus soroeensis voucher SC136	3736	10	441	530	248	480	529	85	501	101 (3)	381	440 (17)
Bombus sporadicus voucher SC193	3805	10	441	599	248 (61)	480	529	85	501	101	381	440 (40)
Bombus steindachneri voucher SC313	3297	9	441	599	248 (1 'N', 1)	0	529	85	473	101 (2)	381	440
Bombus subterraneus voucher SC046	3727	10	441	530	248 (1)	471	529	85	501	101	381	440
Bombus suckleyi voucher SC091	3325	9	441	599	248 (1)	0	529	85	501	101	381	440 (37)
Bombus sulfureus voucher SC064	3219	9	441	594	248	0	529	84	501	90	381	351
Bombus superbus B02	1857	5	441	0	0	0	0	0	501	101	381	433
Bombus supremus voucher SC101	3805	10	441	599	248 (1)	480	529	85	501	101	381	440
*Bombus sushkini v*oucher SC143	3736	10	441	530	248 (1)	480	529	85	501	101	381	440
Bombus sylvarum voucher SC110	3769	10	441	599	248 (1)	480	529	85	501	101	348	437 (44)
Bombus sylvestris voucher SC020	3757	10	441 (1 'N')	599	248 (2)	480	516	85	466	101	381	440 (37)
Bombus sylvicola voucher SC108	3775	10	441	599	248 (78)	477	529	85	501	101	354	440
Bombus ternarius voucher SC116	3736	10	441	530	248 (78)	480	529	85	501	101	381	440
Bombus terrestris voucher SC003	3736	10	441	530	248	480	529	85	501	101	381	440 (47)
Bombus terricola voucher SC205	3736	10	441	530	248	480	529	85	501	101	381	440 (40)
Bombus tibetanus voucher SC134	3325	9	441	599	248 (1)	0	529	85	501	101	381	440 (37)
Bombus tichenkoi J1	2474	7	0	530	248 (1)	480	529	85	501	101	0	0
Bombus transversalis voucher SC314	3777	10	441	599	248 (6)	480	529	85	473	101 (3 'N', 2)	381	440
Bombus tricornis voucher SC148	3736	10	441 (1)	530	248	480	529	85	501	101	381	440
Bombus trifasciatus voucher SC015	3686	10	441 (2)	530	248 (1)	434	525	85	501	101	381	440
Bombus trinominatus voucher SC229	3325	9	441	599	248 (60)	0	529	85	501	101	381	440
Bombus tucumanus voucher SC276	3325	9	441	599	248 (17)	0	529	85	501	101	381	440 (5)
Bombus turkestanicus B03	1857	5	441	0	0	0	0	0	501	101	381	433
Bombus ussurensis voucher SC130	3656	10	412 (2)	530	248 (1)	480	529	85	501	101	350	420 (6)
Bombus vagans voucher SC044	3788	10	424	599	248	480	529	85	501	101	381	440

Taxon	TL (pb)	N	16S	Argk Exon	Argk Intron	COI	EF1α Exon	EF1α Intron	Opsin Exon	Opsin Intron	PEPCK Exon	PEPCKI
Bombus vandykei voucher SC149	3675	10	441	530	248	419	529	85	501	101 (1 'N')	381	440
Bombus variabilis voucher SC316	3297	9	441	599	248 (1)	0	529	85	473	101 (3 'N', 2)	381	440 (37)
Bombus velox voucher SC094	3252	9	441	526	248 (1)	0	529	85	501	101	381	440 (46)
Bombus vestalis voucher SC169	3805	10	441	599	248 (1)	480	529	85	501	101	381	440 (37)
Bombus veteranus voucher SC187	3805	10	441	599	248 (6)	480	529	85	501	101	381	440 (46)
Bombus vogti voucher SC172	3325	9	441	599	248 (17)	0	529	85	501	101	381	440 (5)
Bombus volucelloides voucher SC122	2435	7	441	530	248 (18)	0	529	85	501	101	0	0
Bombus vorticosus voucher SC124	3158	9	441	533	248	0	529	84	501	90	381	351
Bombus vosnesenskii voucher SC112	3580	10	441	530	248 (78)	324	529	85	501	101	381	440
Bombus waltoni voucher SC102	3716	10	441	539	248 (12)	480	529	85	501	101	352	440
Bombus weisi voucher SC315	3500	10	441	599	248 (89)	203	529	85	473 (1 'N')	101 (3 'N', 2)	381	440
Bombus wilmattae voucher SC199	3649	10	441	599	248 (78)	324	529	85	501	101	381	440
Bombus wurflenii voucher SC001	3670	10	441	530	248	414	529	85 (1 'N')	501	101	381	440
Bombus zonatus voucher SC063	3325	9	441	599	248 (17)	0	529	85	501	101	381	440 (46)
Eufriesea pulchra	1634	4	0	530	0	0	529	85	490	0	0	0
Eufriesea surinamensis	2175	5	0	583	0	480	526	85	501	0	0	0
Euglossa championi	2579	6	416 (10)	582	0	480	529	85	487	0	0	0
Euglossa imperialis	2425	6	383 (1)	467	0	460	529	85	501	0	0	0
Eulaema boliviensis	2983	7	441 (2)	599	0	480	529	85	501	0	348	0
Eulaema nigrita	2440	6	416 (5)	474 (2 'N')	0	480 (1 'N')	498	85	487	0	0	0
Geniotrigona thoracica	2423	6	441 (1)	556	0	0	494 (5 'N')	85	475	0	372	0
Heterotrigona itama	2408	6	441 (2)	539	0	0	506	85	486	0	351	0
Hypotrigona gribodoi	2396	6	441	539	0	0	528 (1 'N', 3)	85 (1)	442	0	361	0
Liotrigona mahafalya	2516	6	441	539	0	480	529 (1 'N')	85 (1)	442 (1 'N')	0	0	0
Plebeia frontalis	2413	6	441	539	0	0	529	85 (1)	442	0	377	0

Taxon	TL (pb)	N	16S	Argk Exon	Argk Intron	COI	EF1α Exon	EF1α Intron	Opsin Exon	Opsin Intron	PEPCK Exon	PEPCKI
Trigona amazonensis	2463	6	441 (2)	530	0	0	529	85 (1)	501	0	377 (3)	0

Table S11. Best partitioning schemes and substitution models.

Subset	Best Model	Subset Partitions	Subset Sites
1	GTR+I+G	16S	1-441
2	GTR+I+G	Argk exon 1, EF1α exon 1	442-1040\3, 1769-2297\3
3	GTR+I+G	EF1α exon2, Opsin exon2, Argk exon2	1770-2297\3, 2384-2883\3, 443-1040\3
4	SYM+G	Argk exon3, Opsin exon3, PEPCK exon	444-1040\3, 2385-2883\3, 2987-3365\3
5	GTR+G	Opsin intron, PEPCK intron, Argk intron	2884-2984, 3366-3805, 1041-1288
6	GTR+I+G	COI1	1289-1768\3
7	HKY+I+G	COI2	1290-1768\3
8	GTR+I+G	COI3	1291-1768\3
9	TVM+G	EF1α exon3	1771-2297\3
10	TVM+G	EF1α intron	2298-2382
11	K81UF+I+G	PEPCK exon1, Opsin exon1	2985-3365\3, 2383-2883\3
12	TRNEF+I+G	PEPCK exon2	2986-3365\3

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