

Table S1. Diversity and goods coverage indices generated by 16S region.

Sample name	Shannon index	Simpson index	chao1 index	goods coverage
A1	4.508	0.908	1079.531	0.998
A2	4.667	0.918	877.153	0.999
A3	3.898	0.891	536.734	0.999
B1	4.266	0.911	717.643	0.999
B2	4.316	0.909	762.569	0.999
B3	3.989	0.896	593.327	0.999
C1	2.384	0.629	725.889	0.998
C2	4.034	0.875	649.729	0.999
C3	5.395	0.927	863.944	0.999
D1	3.995	0.877	599.333	0.999
D2	2.222	0.590	417.338	0.999
D3	3.854	0.854	746.887	0.999

Table S2. Diversity and goods coverage indices generated by ITS region.

Sample name	Shannon index	Simpson index	chao1 index	goods coverage
A1	3.960	0.848	626.272	0.999
A2	2.981	0.788	448.036	0.999
A3	3.708	0.844	518.474	0.999
B1	3.489	0.858	413.750	0.999
B2	2.400	0.664	451.800	0.999
B3	2.609	0.726	543.289	0.999
C1	3.465	0.850	245.023	1.000
C2	2.626	0.799	153.000	1.000
C3	3.126	0.826	226.810	1.000
D1	2.742	0.749	166.032	1.000
D2	3.109	0.843	172.111	1.000
D3	2.298	0.709	125.038	1.000

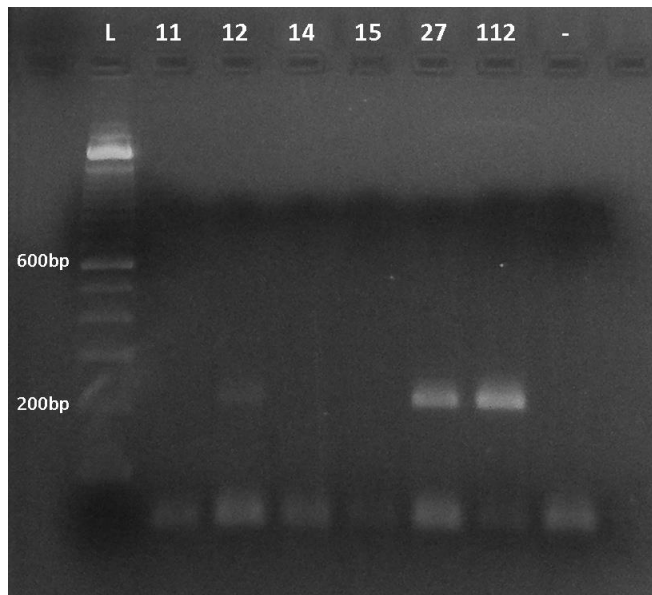


Figure S1. Gel electrophoresis of duplex PCR products for the identification of *V. ceranae*. Each lane corresponds to bee sample tested; L: molecular weight marker (100bp); (-): negative control.



Figure S2. OTU annotation tree construct for group A generated by the 16S bacterial region. Different taxonomic ranks range inside out. The size of circles stands for abundance of species. Different colors stand for different phyla. Solid circles stand for the top 40 species in high abundance. Full size constructs are provided as supplementary material.



Figure S3. OTU annotation tree construct for group B generated by the 16S bacterial region. Different taxonomic ranks range inside out. The size of circles stands for abundance of species. Different colors stand for different phyla. Solid circles stand for the top 40 species in high abundance. Full size constructs are provided as supplementary material.

A.c--Acidobacteriae
 B.o--Acidobacteriales
 C.c--Bacilli
 D.o--Lactobacillales
 E.f--Lactobacillaceae
 F.g--Lactobacillus
 G.c--Clostridia
 H.c--Gammaproteobacteria
 I.o--Enterobacteriales
 J.f--Morganellaceae
 K.g--Buchnera
 L.g--Arsenophonus
 M.f--Enterobacteriaceae
 N.g--Escherichia-Shigella
 O.c--Alphaproteobacteria
 P.o--Rickettsiales
 Q.f--Mitochondria
 R.g--Mitochondria
 S.o--Rhizobiales
 T.f--Beijerinckiaceae
 U.g--Roseiarcus
 V.c--Actinobacteria
 W.o--Corynebacteriales
 X.f--Mycobacteriaceae
 Y.g--Mycobacterium
 Z.c--Acidimicrobia
 a.c--Nitrososphaeria
 b.o--Nitrososphaerales
 c.f--Nitrososphaeraeae

OTU Tree of C by GraPhlAn

P-ACIDOBACTERIOTA
 P-ACTINOBACTERIOTA
 P-CRENARCHAEOTA
 P-FIRMICUTES
 P-PROTEOBACTERIA

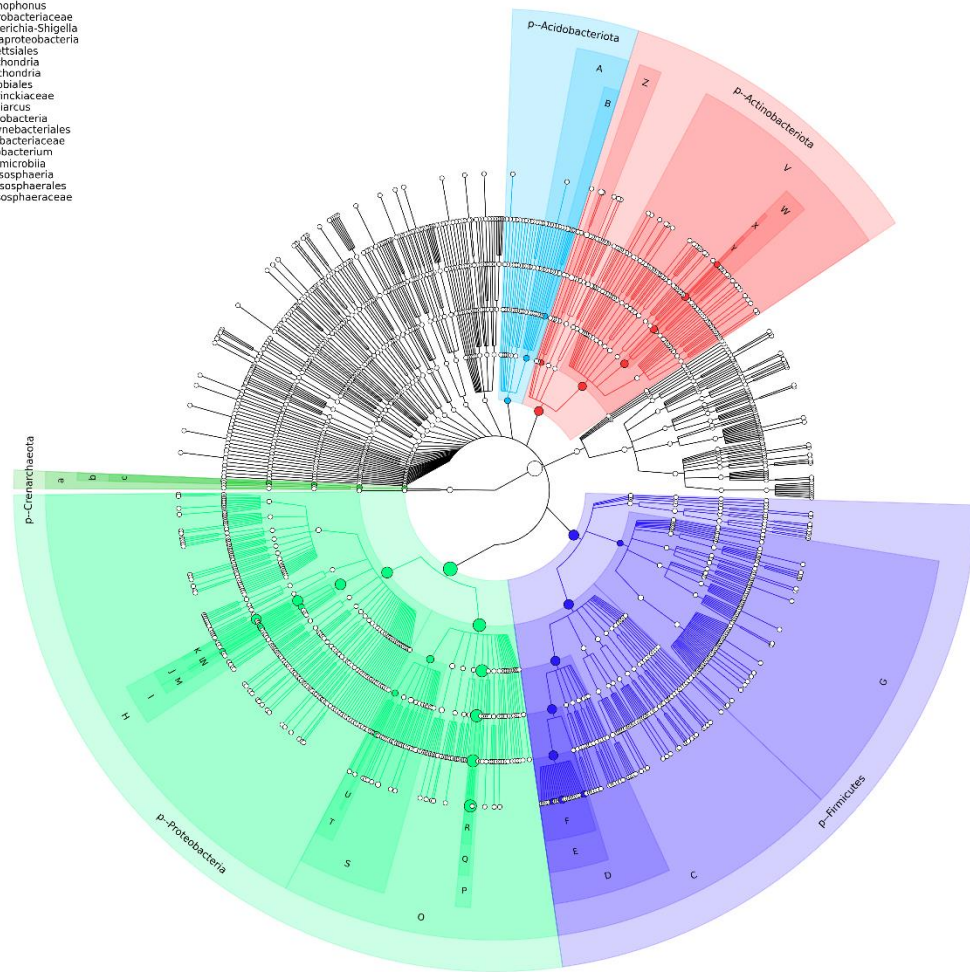


Figure S4. OTU annotation tree construct for group C generated by the 16S bacterial region. Different taxonomic ranks range inside out. The size of circles stands for abundance of species. Different colors stand for different phyla. Solid circles stand for the top 40 species in high abundance. Full size constructs are provided as supplementary material.



Figure S5. OTU annotation tree construct for group D generated by the 16S bacterial region. Different taxonomic ranks range inside out. The size of circles stands for abundance of species. Different colors stand for different phyla. Solid circles stand for the top 40 species in high abundance. Full size constructs are provided as supplementary material.

A:c-Sordariomycetes
 B:o-Sordariales
 C:f-Chaetomiaceae
 D:g-Chaetomium
 E:c-Eurotiomycetes
 F:c-Leotiomycetes
 G:o-Helotiales
 H:c-Saccharomycetes
 I:o-Saccharomycetales
 J:f-Saccharomycetaceae
 K:g-Lachancea
 L:c-Dothideomycetes
 M:o-Capnodiales
 N:f-Mycosphaerellaceae
 O:g-Mycosphaerella
 P:o-Pleosporales
 Q:f-Didymellaceae
 R:f-Pleosporaceae
 S:g-Alternaria
 T:g-Stemphylium
 U:c-Tremellomycetes
 V:o-Tremellales
 W:c-Agaricomycetes
 X:o-Gomphales
 Y:f-Gomphaceae
 Z:g-Ramaria
 a:c-Glomeromycetes
 b:o-Glomerales
 c:f-Glomeraceae
 d:g-Glomus

OTU Tree of A by GraPhlAn

P-ASCOMYCOTA
 P-BASIDIOMYCOTA
 P-GLOMEROMYCOTA



Figure S6. OTU annotation tree construct for group A generated by the ITS fungal region. Different taxonomic ranks range inside out. The size of circles stands for abundance of species. Different colors stand for different phyla. Solid circles stand for the top 40 species in high abundance. Full size constructs are provided as supplementary material.

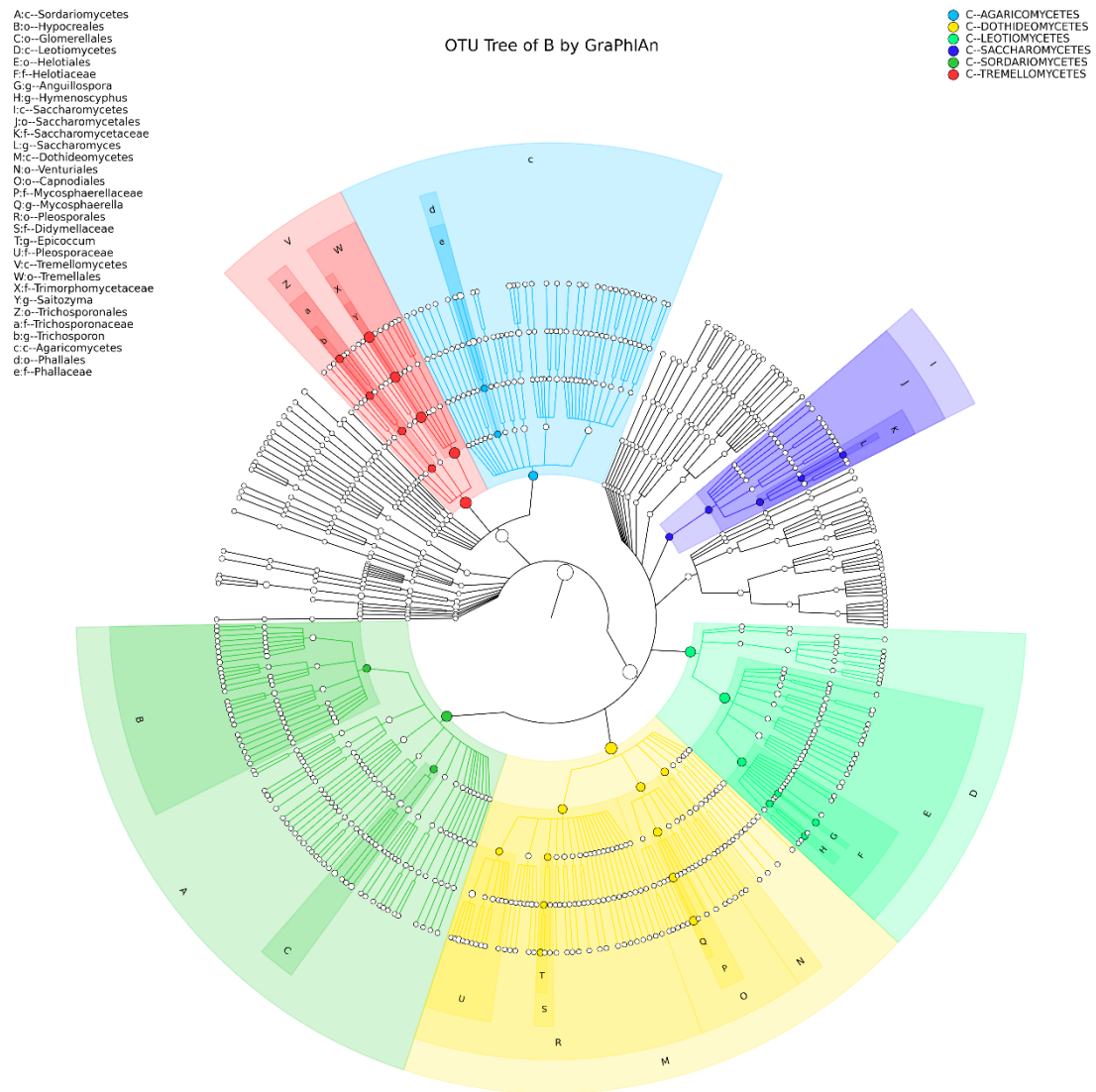


Figure S7. OTU annotation tree construct for group B generated by the ITS fungal region. Different taxonomic ranks range inside out. The size of circles stands for abundance of species. Different colors stand for different phyla. Solid circles stand for the top 40 species in high abundance. Full size constructs are provided as supplementary material.

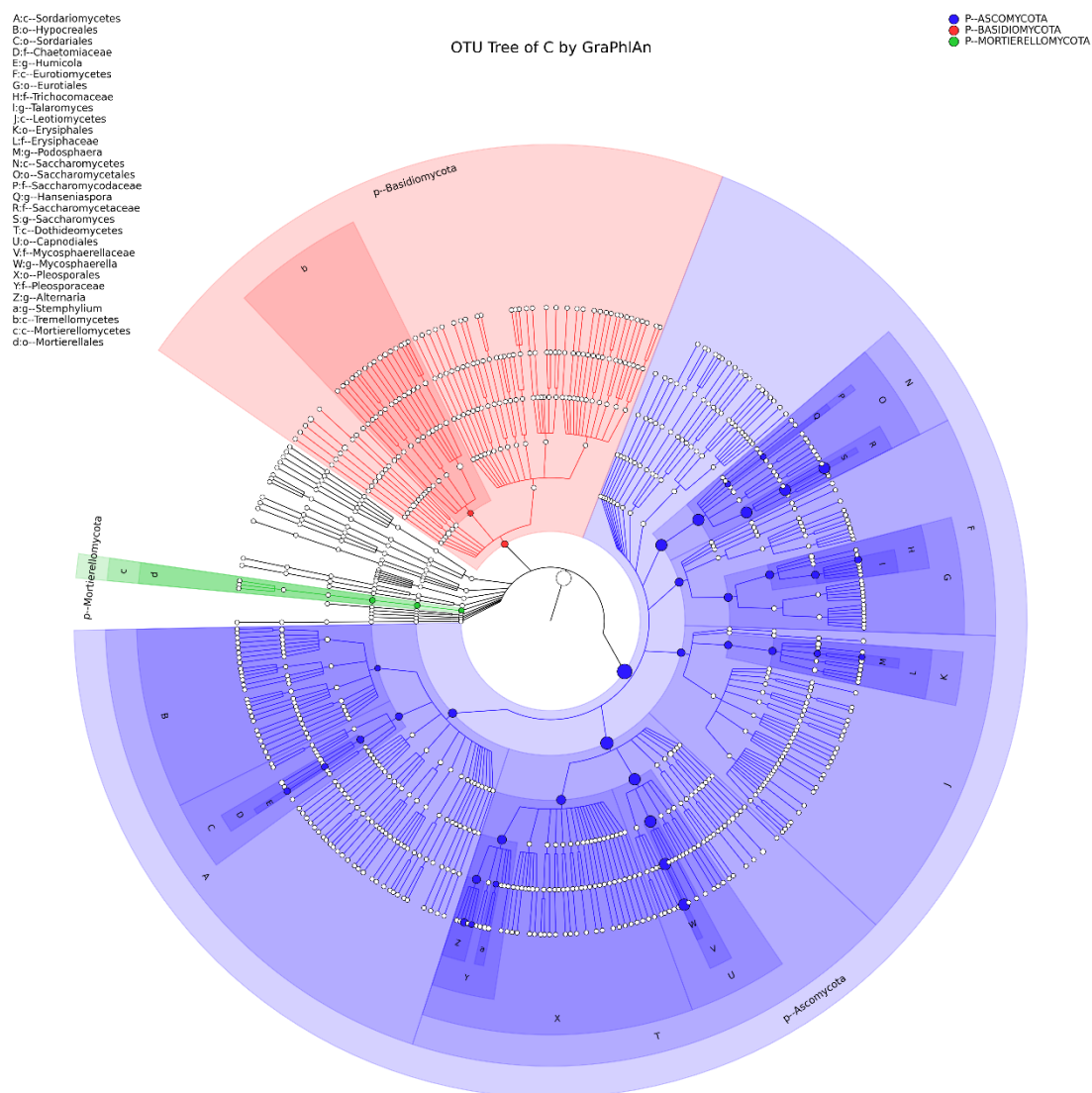


Figure S8. OTU annotation tree construct for group C generated by the ITS fungal region. Different taxonomic ranks range inside out. The size of circles stands for abundance of species. Different colors stand for different phyla. Solid circles stand for the top 40 species in high abundance. Full size constructs are provided as supplementary material.

A:c--Sordariomycetes
 B:o--Sordariales
 C:f--Chaetomiaceae
 D:g--Botryotrichum
 E:g--Humicola
 F:c--Leotiomyces
 G:o--Erysiphales
 H:f--Erysiphaceae
 I:g--Erysiphe
 J:c--Pezizomycetes
 K:o--Pezizales
 L:f--Pezizaceae
 M:g--Iodophanus
 N:c--Saccharomycetes
 O:o--Saccharomycetales
 P:f--Saccharomycodaceae
 Q:g--Hanseniaspora
 R:f--Saccharomycetaceae
 S:g--Saccharomyces
 T:c--Dothideomycetes
 U:o--Dothideales
 V:f--Aureobasidiaceae
 W:g--Aureobasidium
 X:o--Pleosporales
 Y:f--Pleosporaceae
 Z:g--Alternaria
 a:c--Ustilaginomycetes
 b:o--Urocystidales
 c:f--Glomosporiaceae
 d:g--Thecaphora

OTU Tree of D by GraPhlAn

● C--DOTHIDEOMYCETES
 ● C--LEOTIOMYCETES
 ● C--PEZIZOMYCETES
 ● C--SACCHAROMYCETES
 ● C--SORDARIOMYCETES
 ● C--USTILAGINOMYCETES

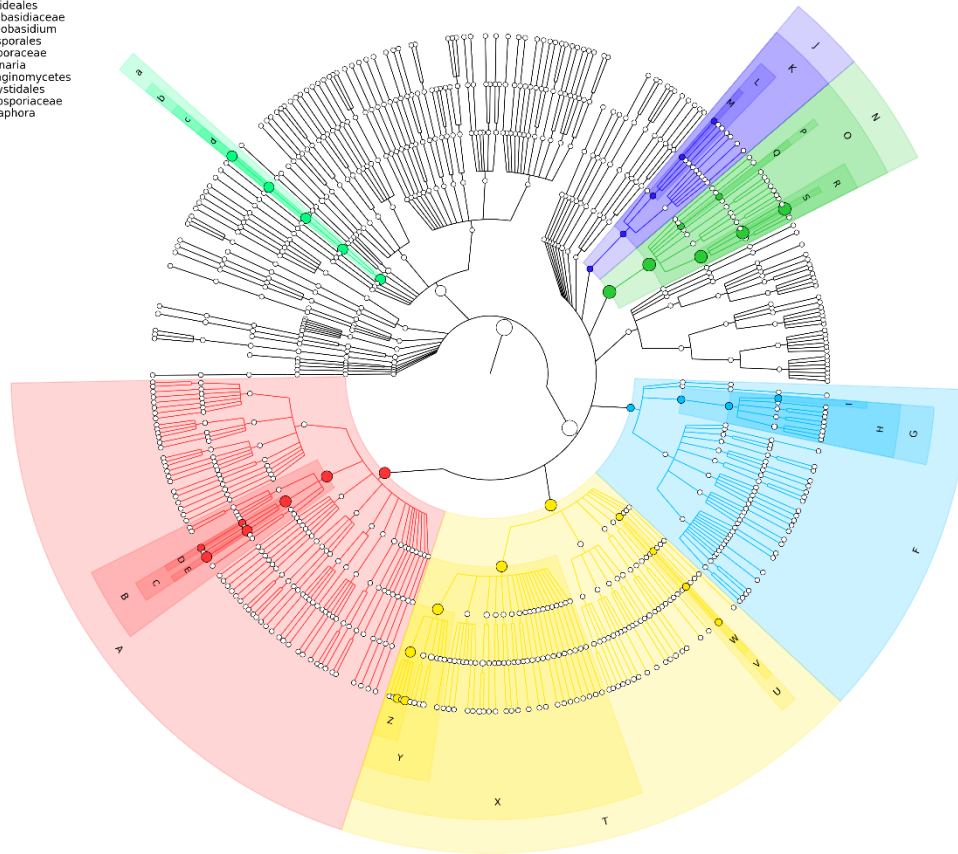


Figure S9. OTU annotation tree construct for group D generated by the ITS fungal region. Different taxonomic ranks range inside out. The size of circles stands for abundance of species. Different colors stand for different phyla. Solid circles stand for the top 40 species in high abundance. Full size constructs are provided as supplementary material.