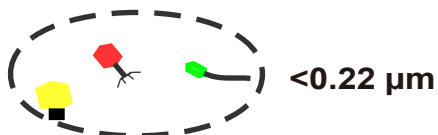
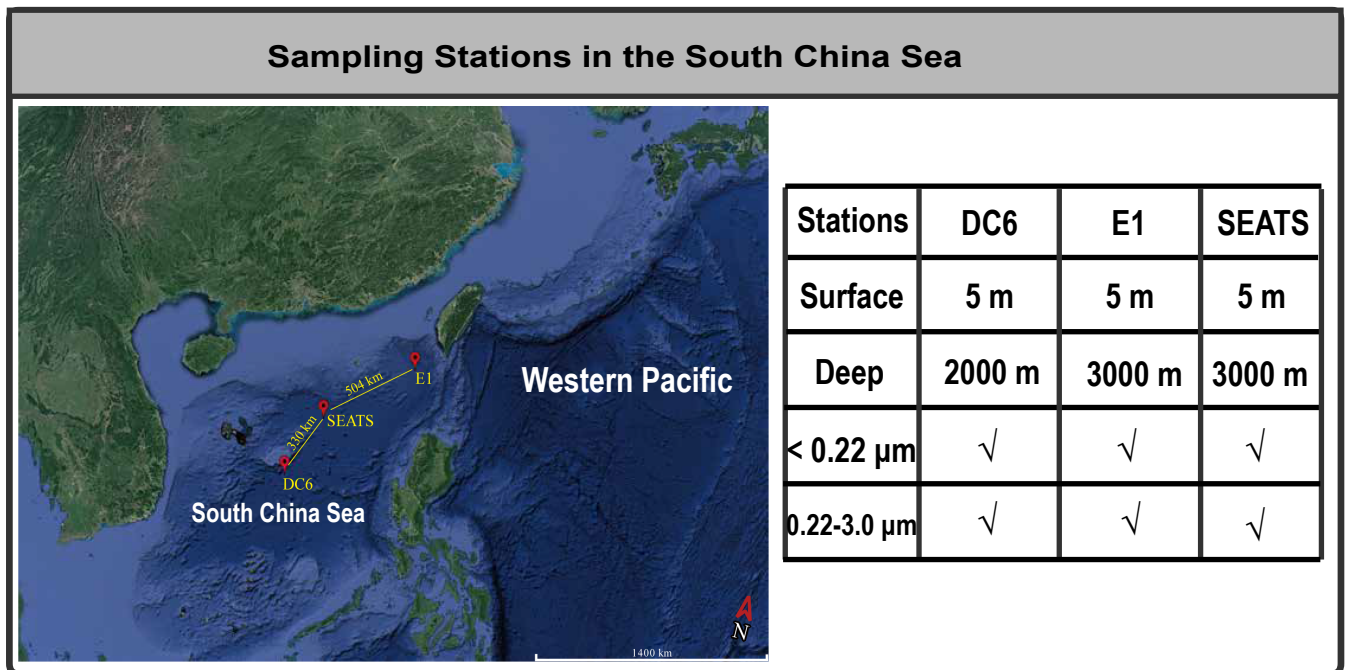


**Fig. S1**



Concentrate by large-scale Tangential Flow Filtration Purified by CsCl density gradient ultracentrifugation



Concentrate on the 0.22  $\mu\text{m}$  membrane (Millipore, Bedford, MA, USA)

**DNA Extraction**

Phenol/chloroform/isoamylol method

MoBio PowerLyzer Powersoil DNA Isolation Kit (Mo Bio Laboratories, Inc., Carlsbad, CA, USA)

Sequencing by Illumina NovaSeq 6000 (2 x 150 bp)

High Quality Trim

**Contig Assembly**

metaSPAdes v3.12.0

MEGAHIT v 1.0.3

**Screening for viral contigs by VirSorter V1 and vMAGs by PHAMB**

**Viral-fraction Viral Contig (VVC)**  
13,265 VVCs

**Viral-fraction Viral MAG (V-vMAG)**  
514 V-vMAGs

**Cellular-fraction Viral Contig (CVC)**  
8,119 CVCs

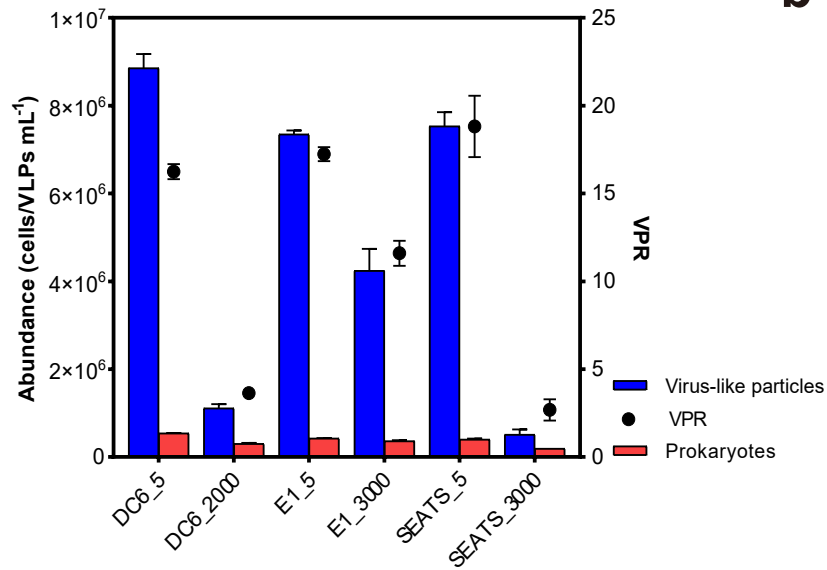
**Cellular-fraction Cellular MAG (C-vMAG)**  
284 C-vMAGs

**High quality (VVG)**  
321 VVGs

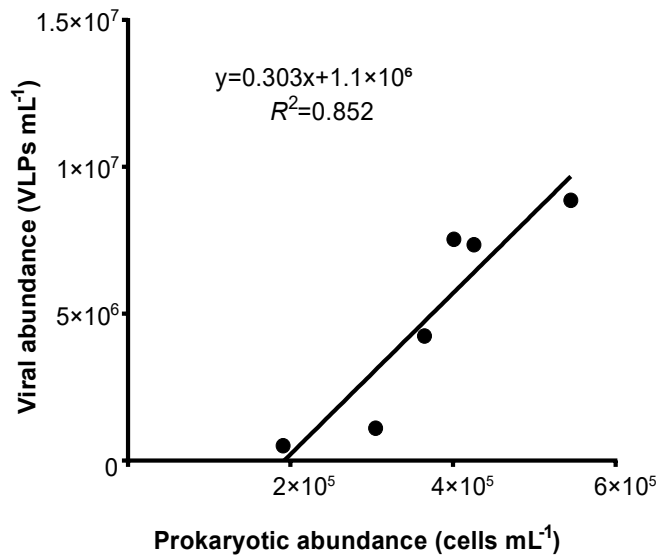
**High quality (CVG)**  
95 CVGs

Fig. S2

a

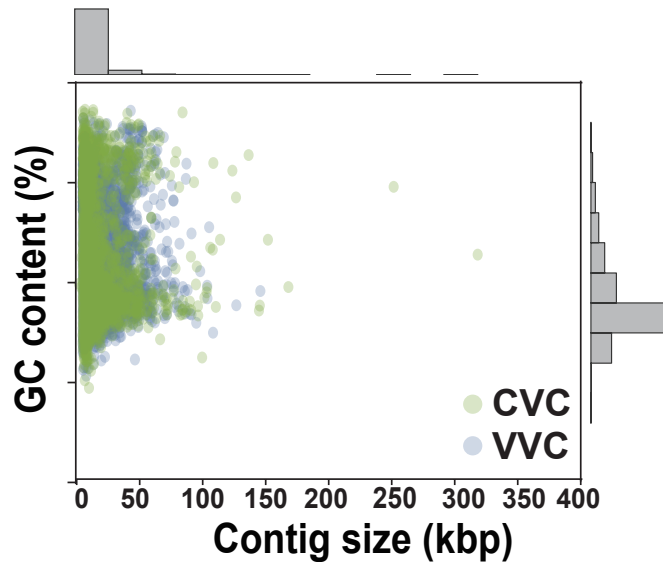


b

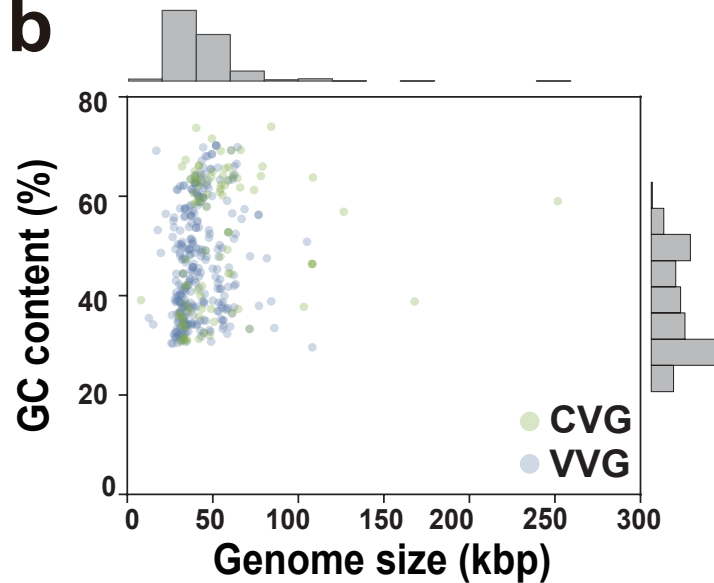


**Fig. S3**

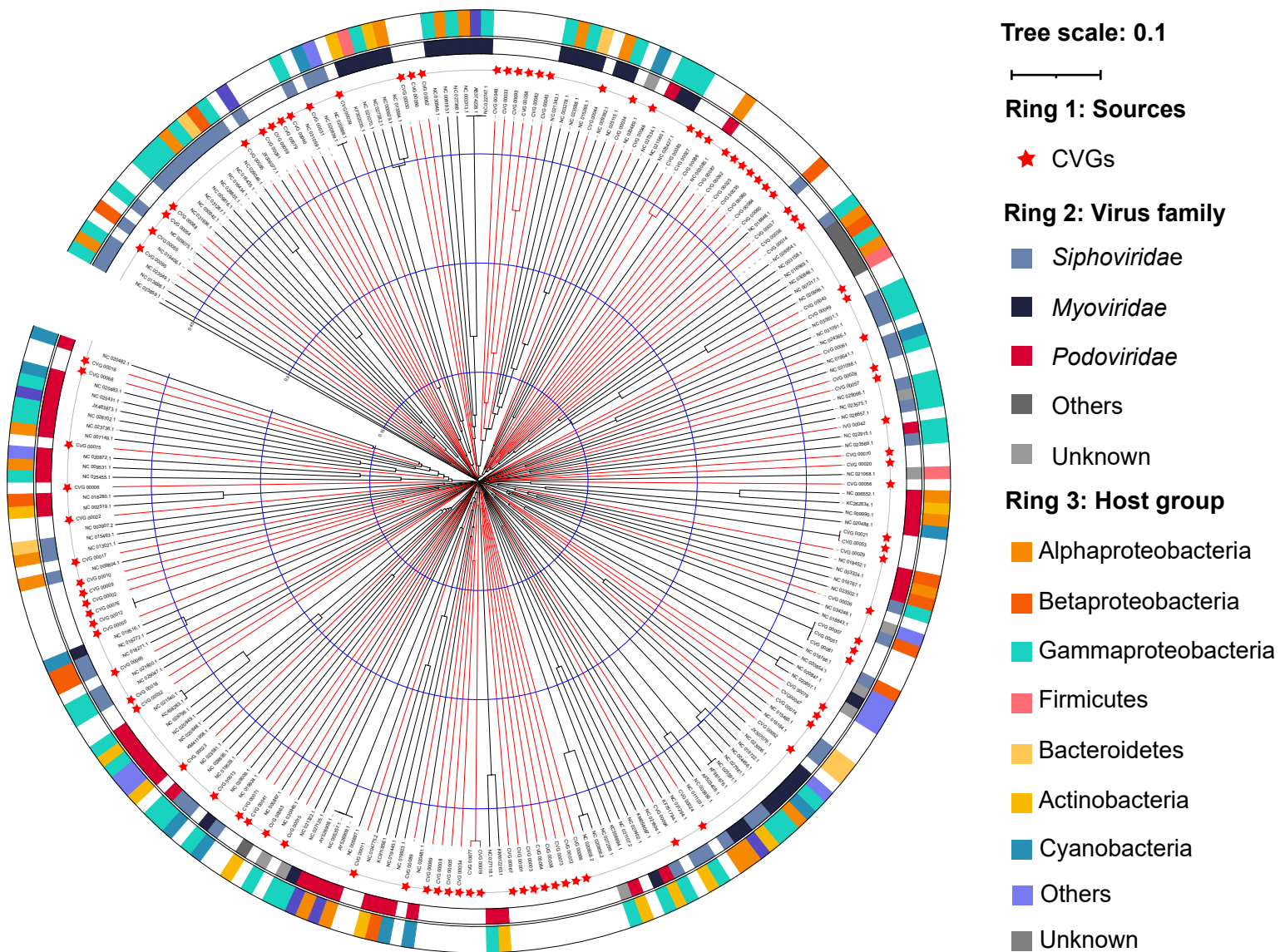
**a**



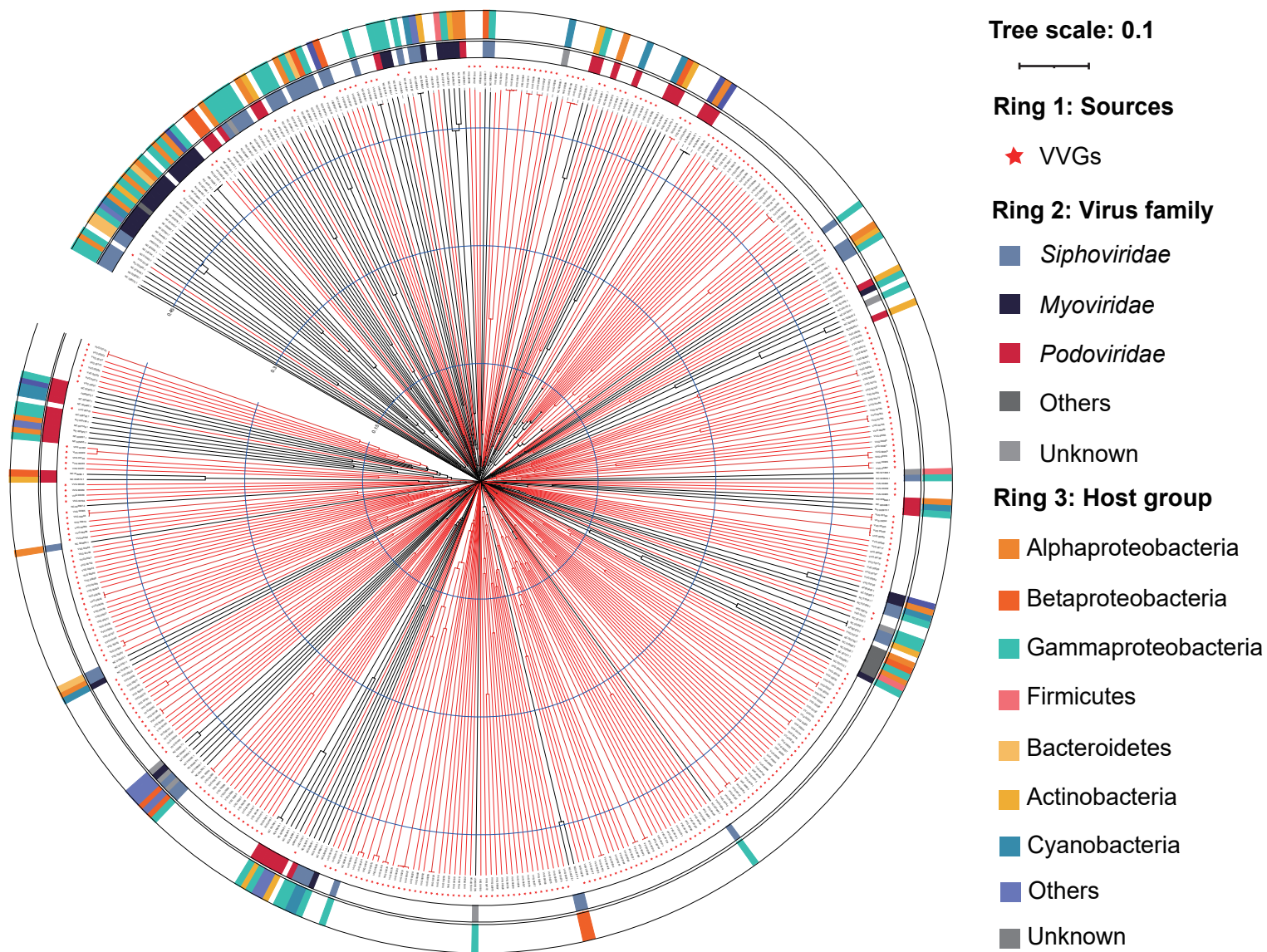
**b**



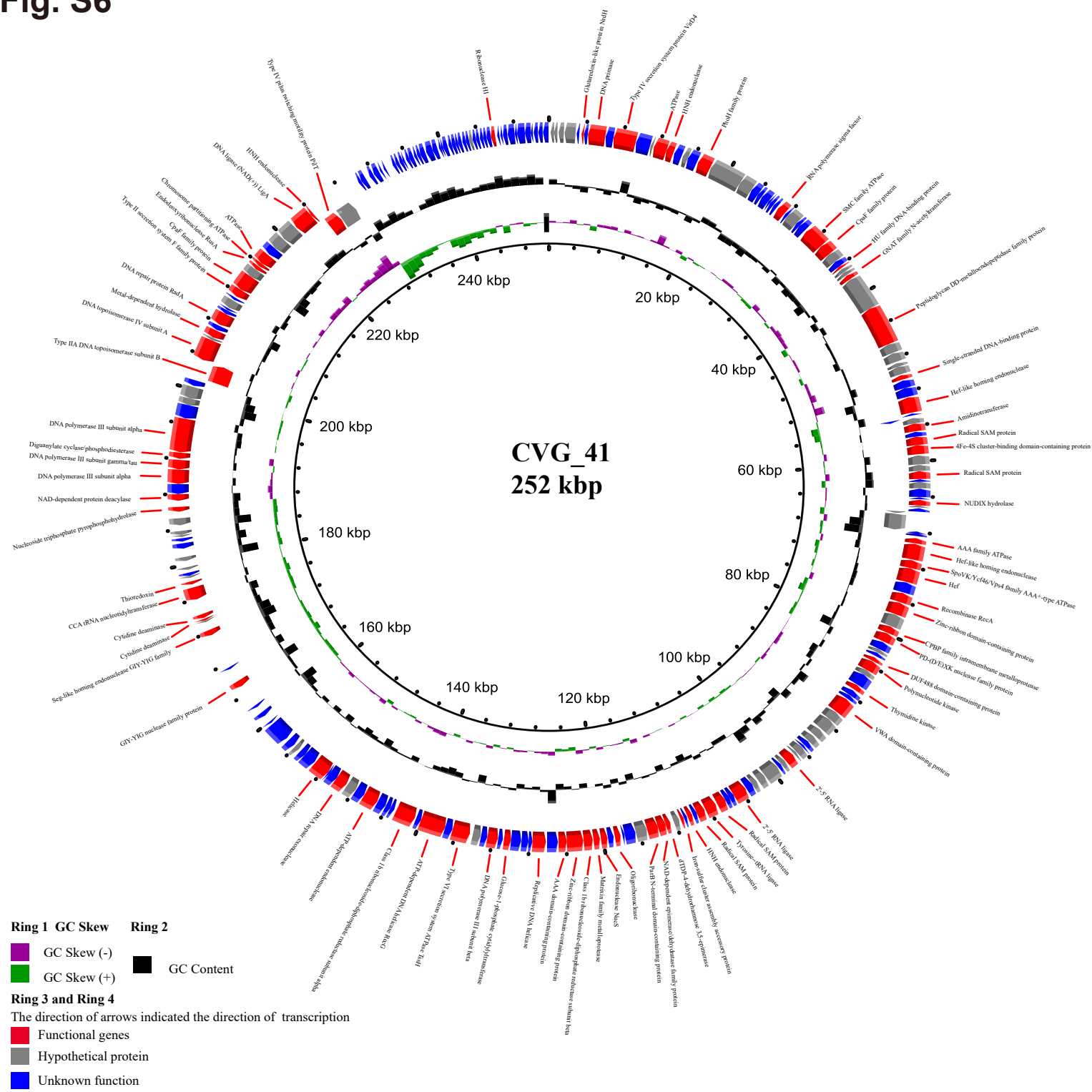
**Fig. S4**



**Fig. S5**

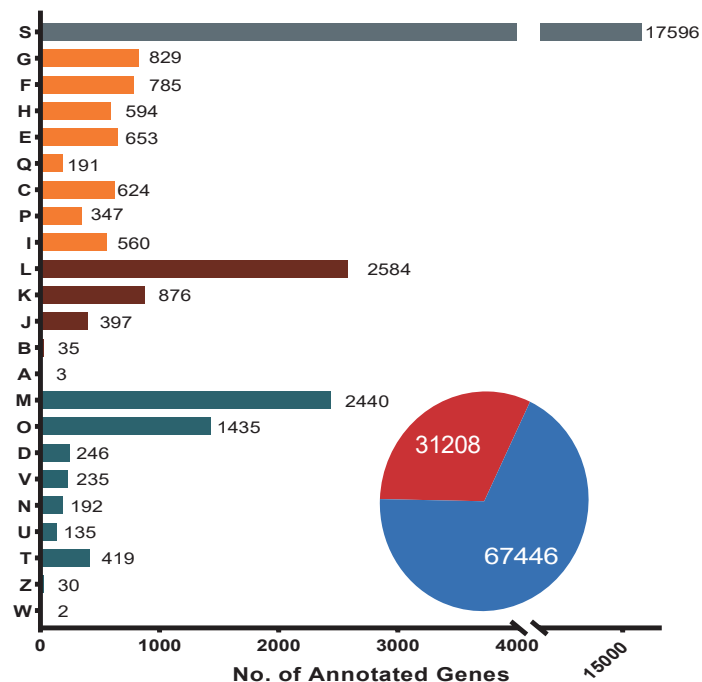


# Fig. S6



# Fig. S7

## a



### Metabolism

- G Carbohydrate transport and metabolism
- F Nucleotide transport and metabolism
- H Coenzyme transport and metabolism
- E Amino acid transport and metabolism
- C Energy production and conversion
- P Inorganic ion transport and metabolism
- I Lipid transport and metabolism
- Q Secondary metabolites biosynthesis, transport and catabolism

### Information storage and processing

- K Transcription
- L Replication, recombination and repair
- B Chromatin structure and dynamics
- A RNA processing and modification
- J Translation, ribosomal structure and biogenesis

### Poorly characterized

- S Function unknown

### Cellular processes and signaling

- M Cell wall/membrane/envelope biogenesis
- O Posttranslational modification, protein turnover, chaperones
- D Cell cycle control, cell division, chromosome partitioning
- V Defense mechanisms
- N Cell motility
- U Intracellular trafficking, secretion, and vesicular transport
- T Signal transduction mechanisms
- Z Cytoskeleton
- W Extracellular structures

## b

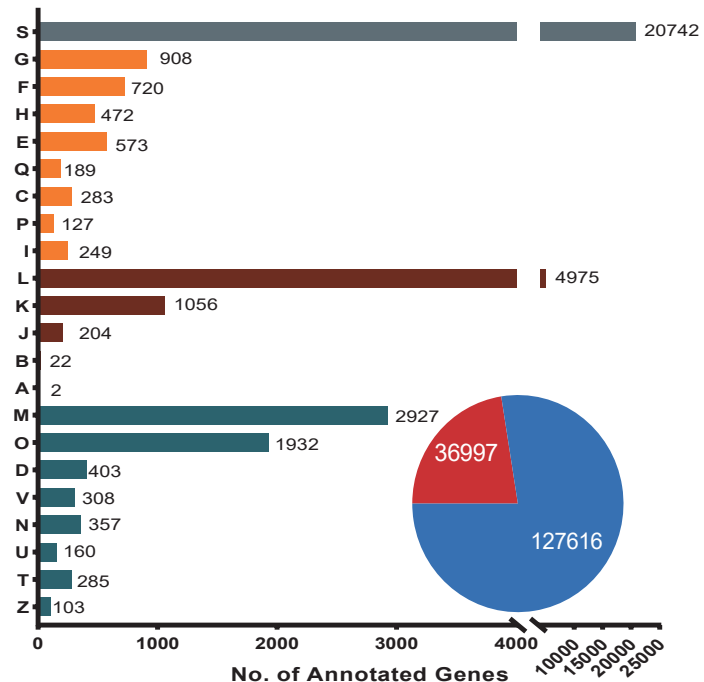


Fig. S8

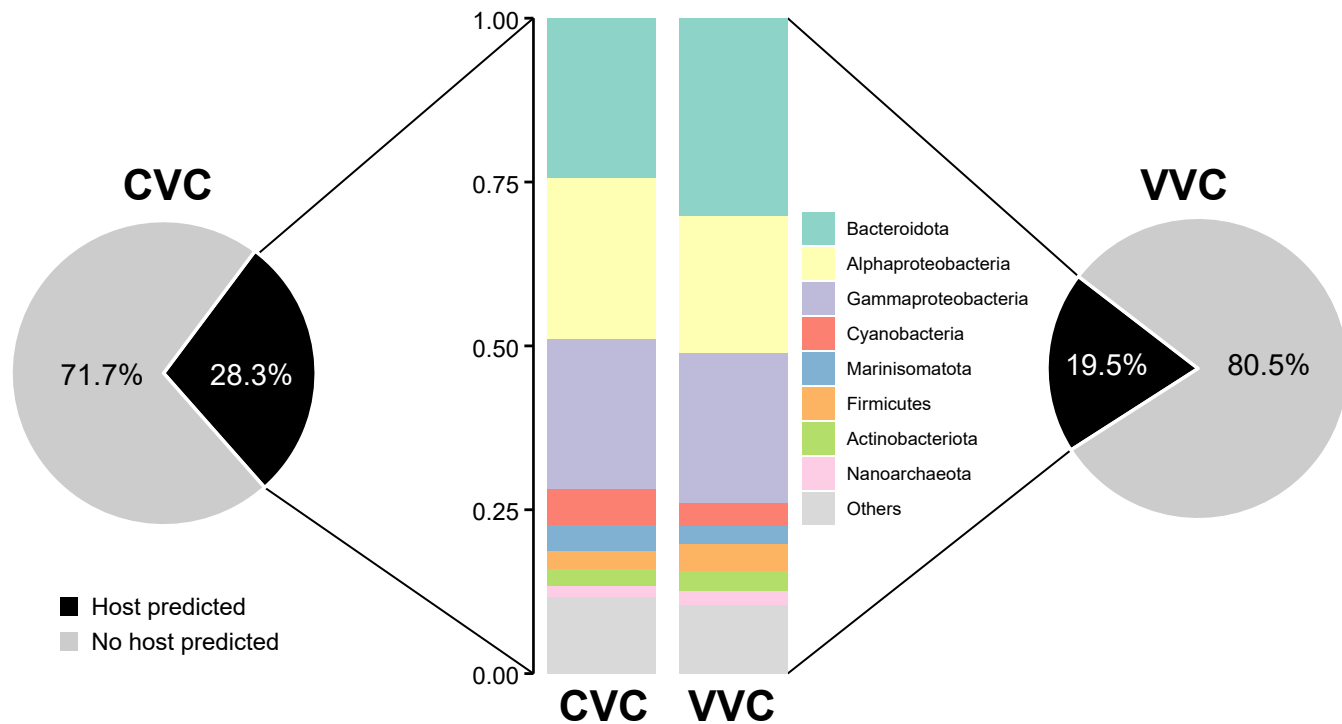




Fig. S9

Inner ring: Virus family

- Iridoviridae (39)
- Phycodnaviridae (27)
- Marseilleviridae (13)
- Others (34)

Outer ring: Host group

- Chordata (32)
- Chlorophyta (19)
- Discosea (18)
- Arthropoda (13)
- Haptophyta (3)
- Others (4)

