Urban avian viromes reveal viral diversity of potential public health relevance across China

Xiang Lu[1#], Chunmei Wang[2#], Juan Xu[3#], Shixing Yang[1], Likai Ji[1], Wang Li[3], Quan Shen[1], Xiaochun Wang[1], Yuwei Liu[1], Ping Wu[1], Yun Feng[1], Gaiping Zhang[4*], Chenglin Zhou[3*], Wen Zhang[1*], Tongling Shan[2*]



[1]Department of Laboratory Medicine, School of Medicine, Jiangsu University, Zhenjiang, China
[2]Shanghai Veterinary Research Institute, Chinese Academy of Agricultural Sciences, Shanghai, China
[3]Clinical Laboratory Center, The Affiliated Taizhou People's Hospital of Nanjing Medical University, Taizhou, China
[4]College of Veterinary Medicine, Henan Agricultural University, Zhengzhou, China

Xiang Lu, Chunmei Wang, Juan Xu, Shixing Yang, Likai Ji, Wang Li, Quan Shen, et al. 2026. Urban avian viromes reveal viral diversity of potential public health relevance across China. ***iMeta*** 5: e70191. https://doi.org/10.1002/imt2.70191.

Introduction

Why is it necessary to systematically investigate avian viromes at the urban scale?

01 Avian viral ecology

Birds are highly diverse and wide-ranging, serving as important hosts for various viruses.

Bird feces provide valuable information on diverse viral sequences.

02 Urban human–animal interface

Urbanization reshapes habitats and contact networks, altering ecological interactions among birds, humans, domestic animals, and other wildlife.

03 Limited cross-city evidence

Previous studies have primarily focused on specific pathogens or single regions, with some relying on pooled sequencing libraries. Standardized comparisons at the individual-sample level remain limited.

Highlights

Samples and viral profiling



17439
Euraryotic

34875
Bacteriophages

High viral novelty

4746
vertebrate-associated
viral sequences

4143
DNA Virus

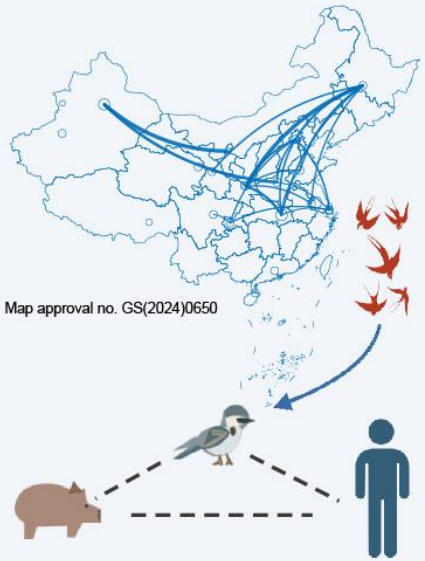
603
RNA Virus

< 80% similarity

65.6%
2718 / 4143

45.8%
276 / 603

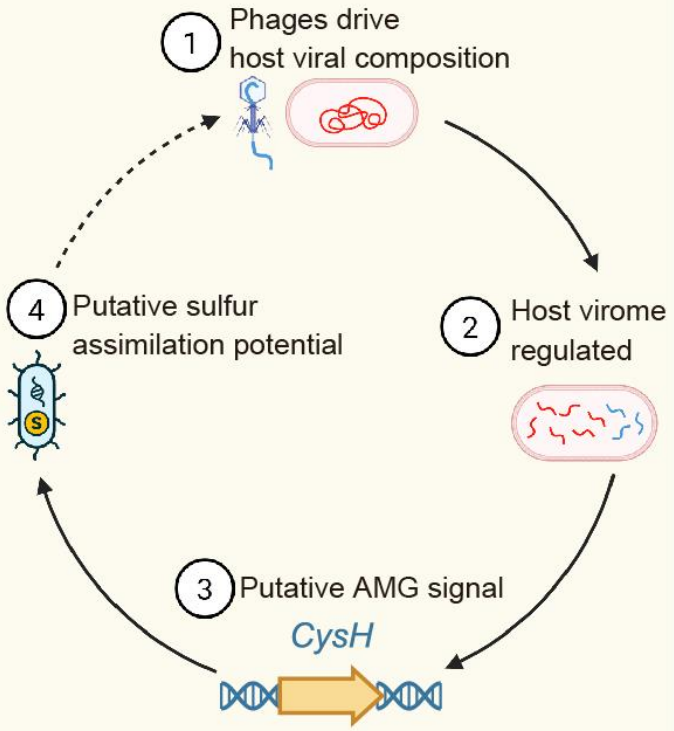
Cross transmission



16 virus genera
Human associated

105 sequences
Host taxa

Phage functional potential

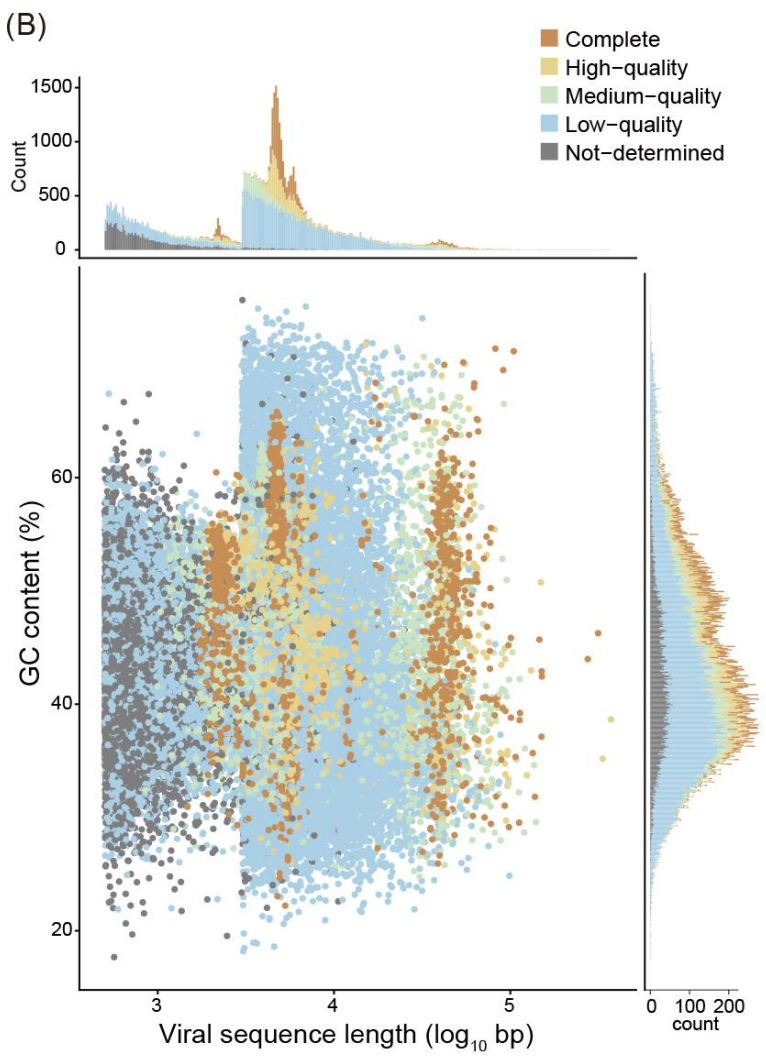


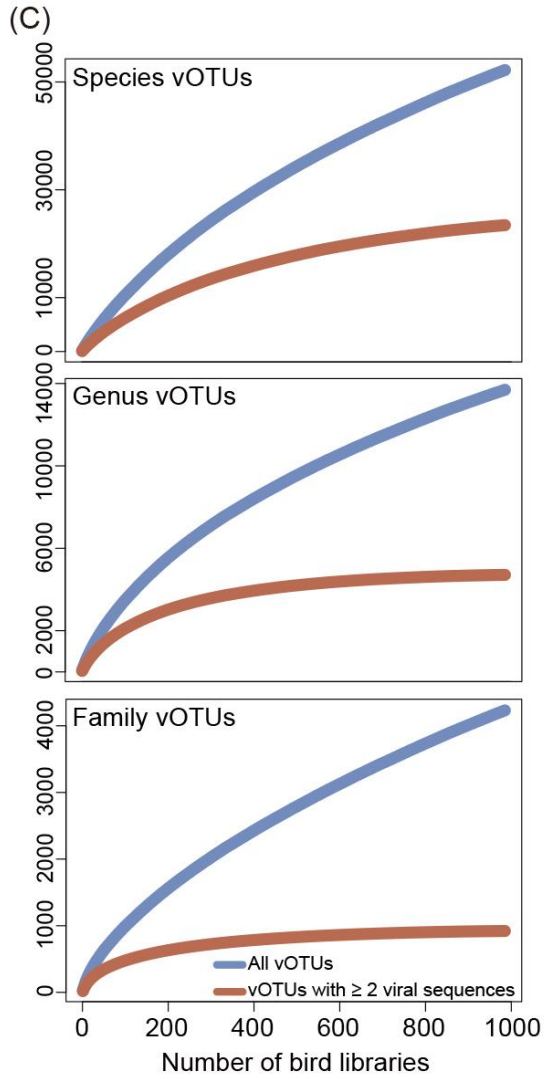
Large-scale survey of the urban avian virome

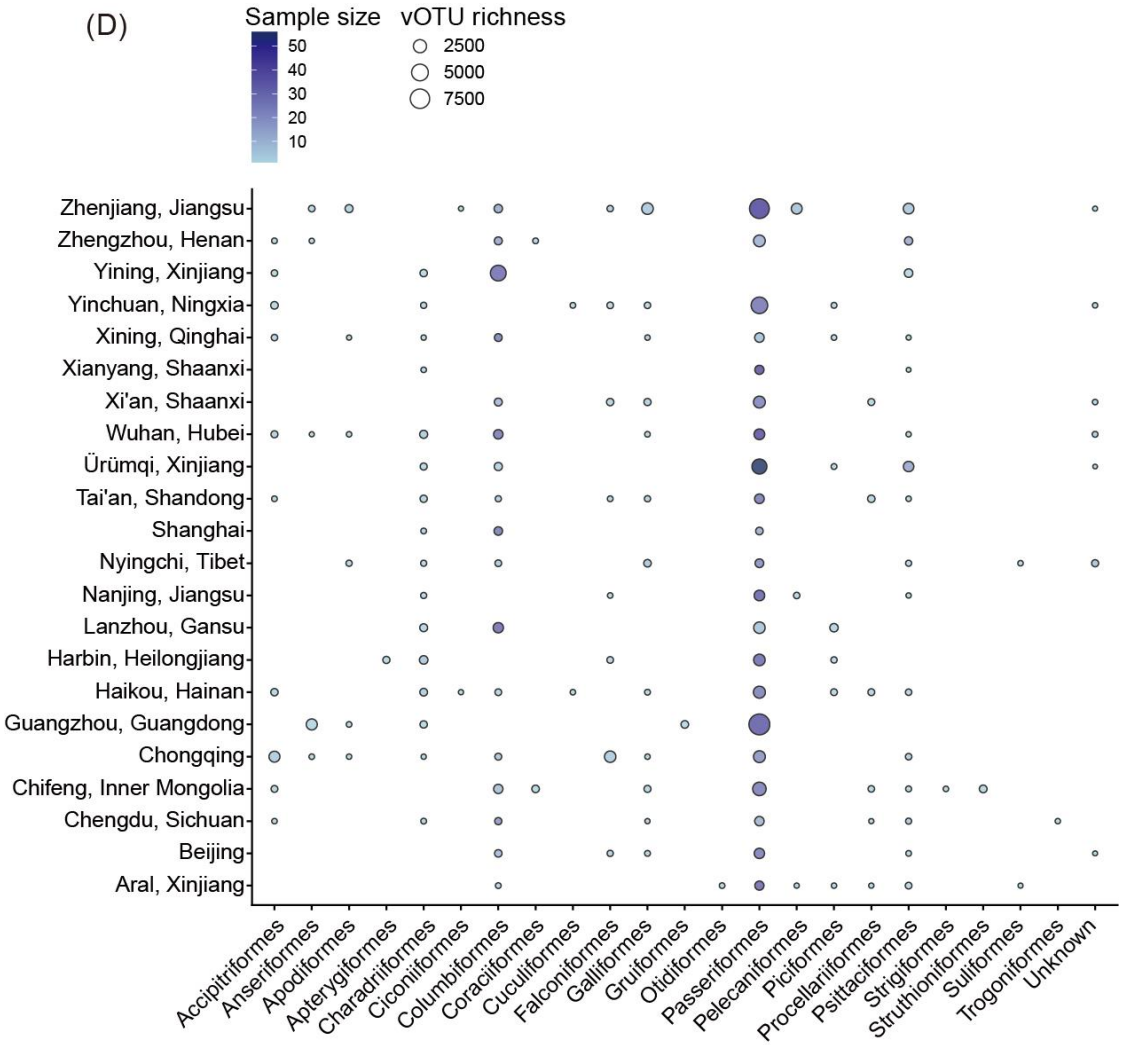
(A)



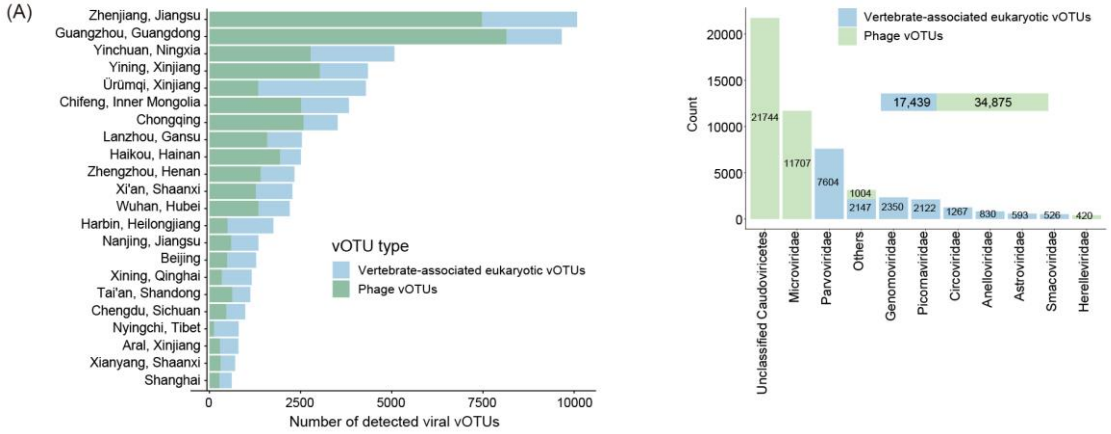
Large-scale survey of the urban avian virome

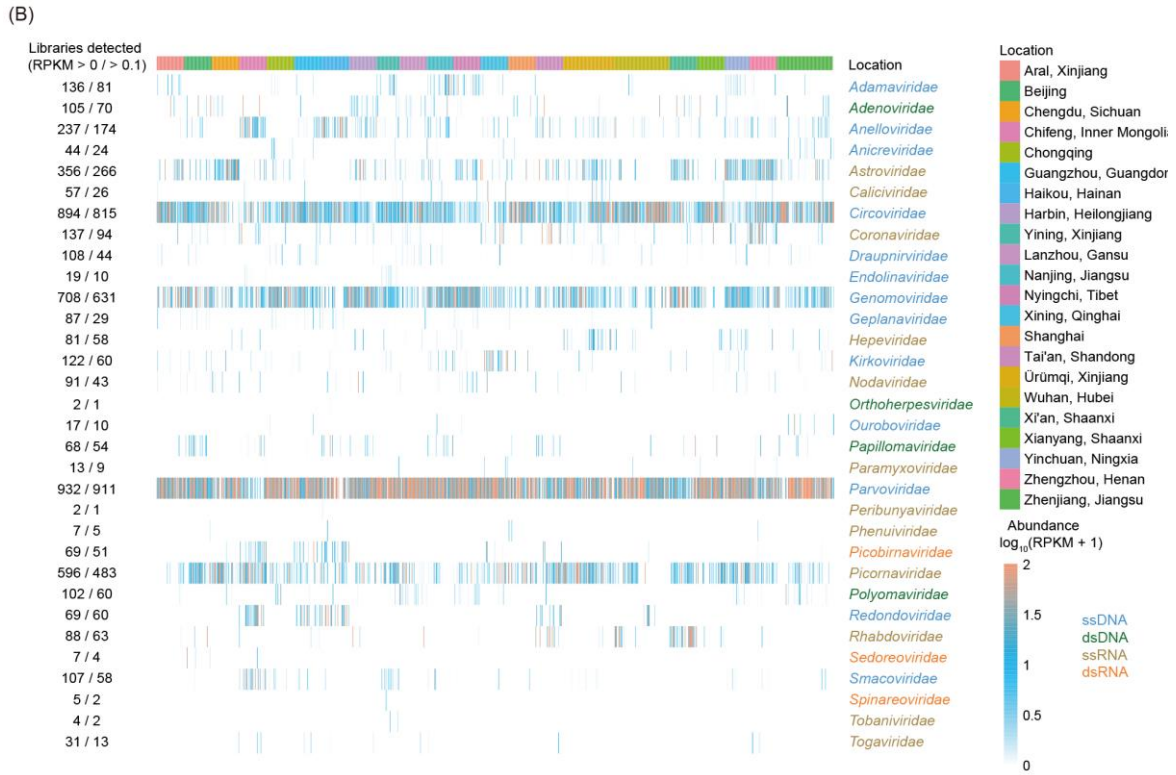


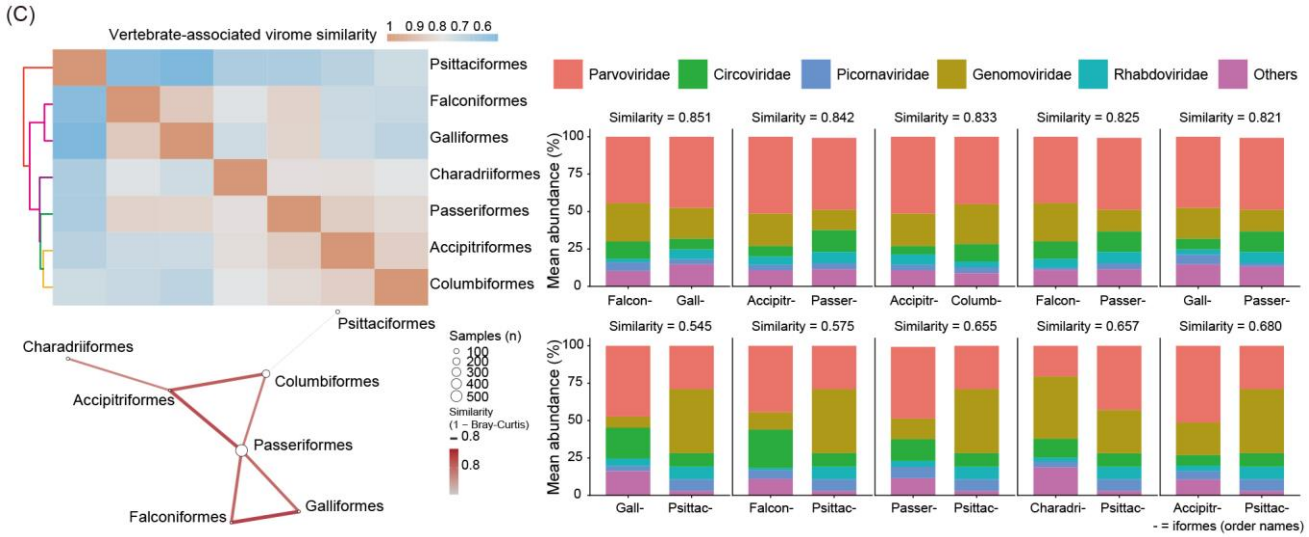




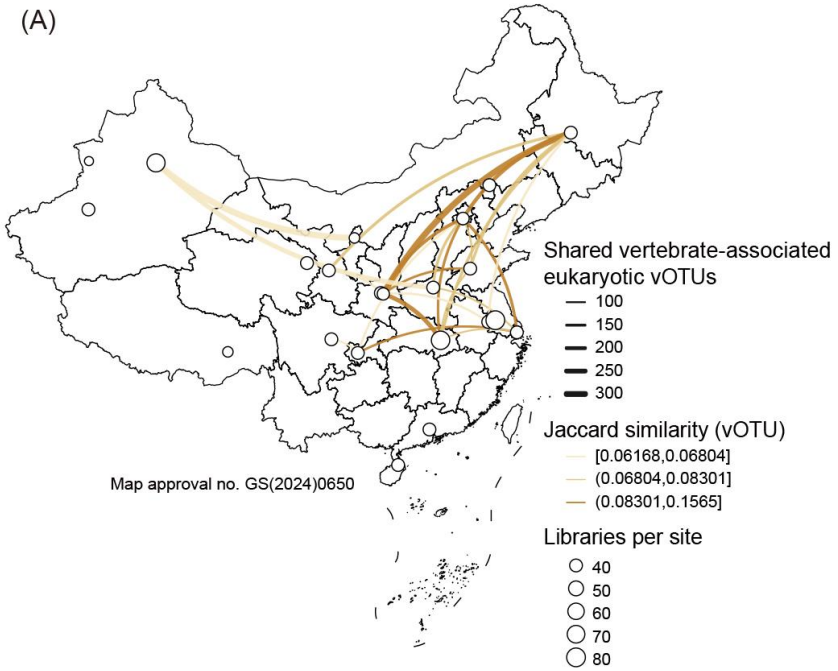
Urban patterns of vertebrate- and phage-associated viruses

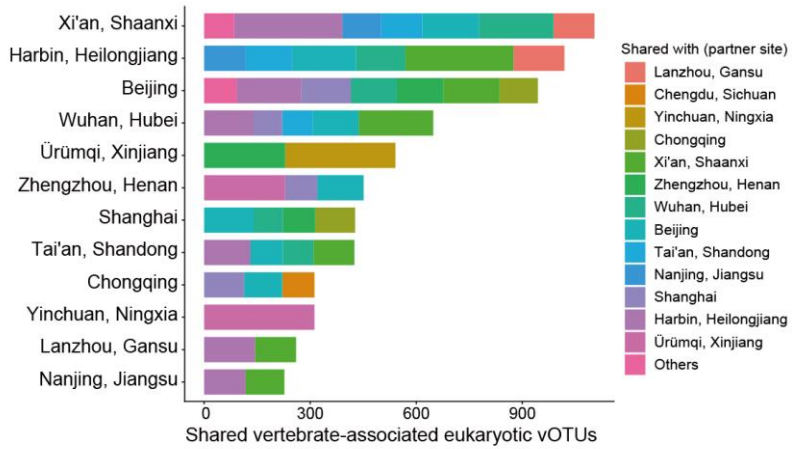


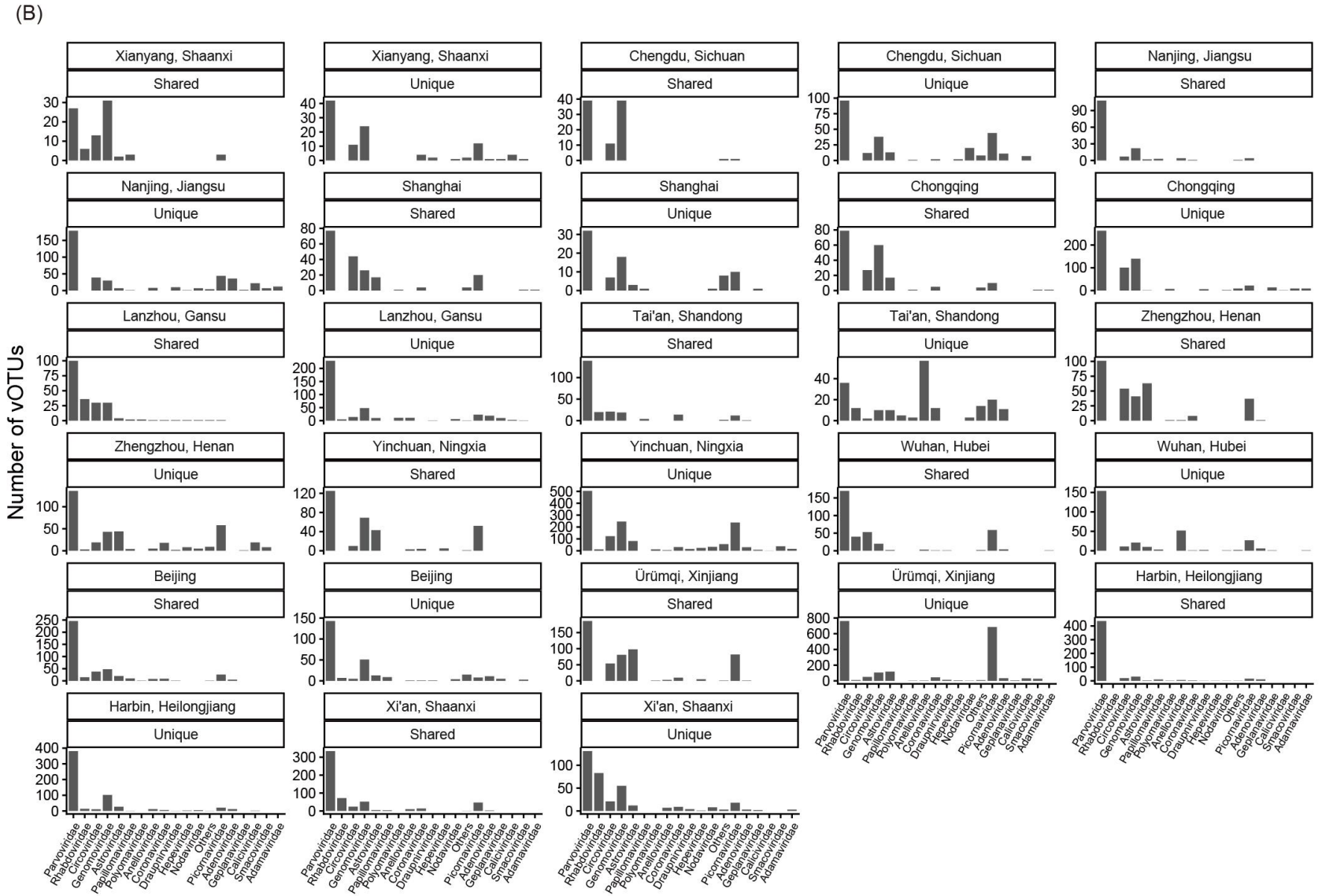




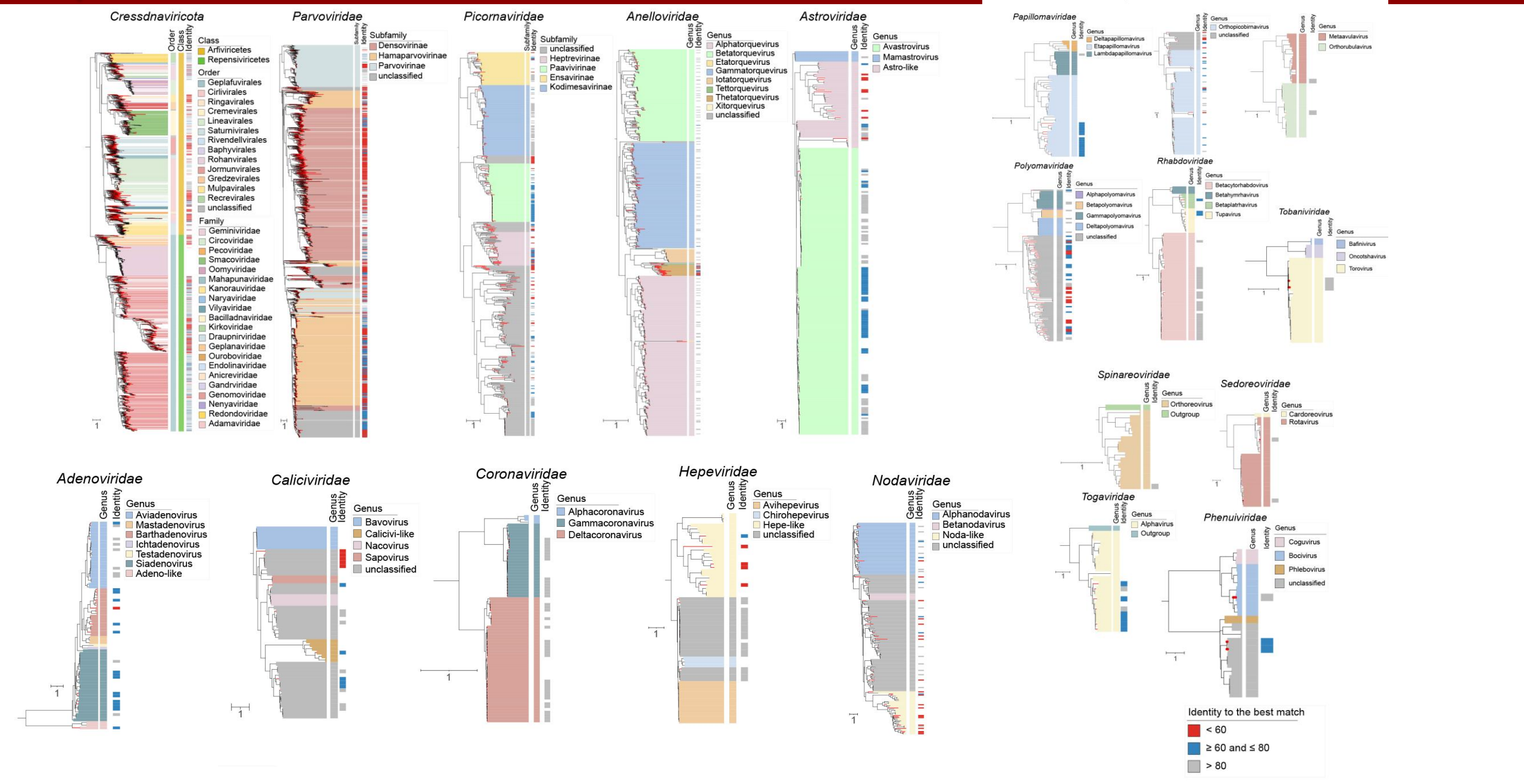
Geographic structuring of shared vertebrate-associated viromes







Diversification and evolution of viruses in urban birds



Sequence similarity associations with reference-annotated hosts



Node type
- Ref. species
- Ref. order
- Virus genus

Edge type
- BLASTn association (genus-reference species)
- Taxonomic membership (species-order)

Association records (genus / species)
- 25
- 50
- 75
- 100

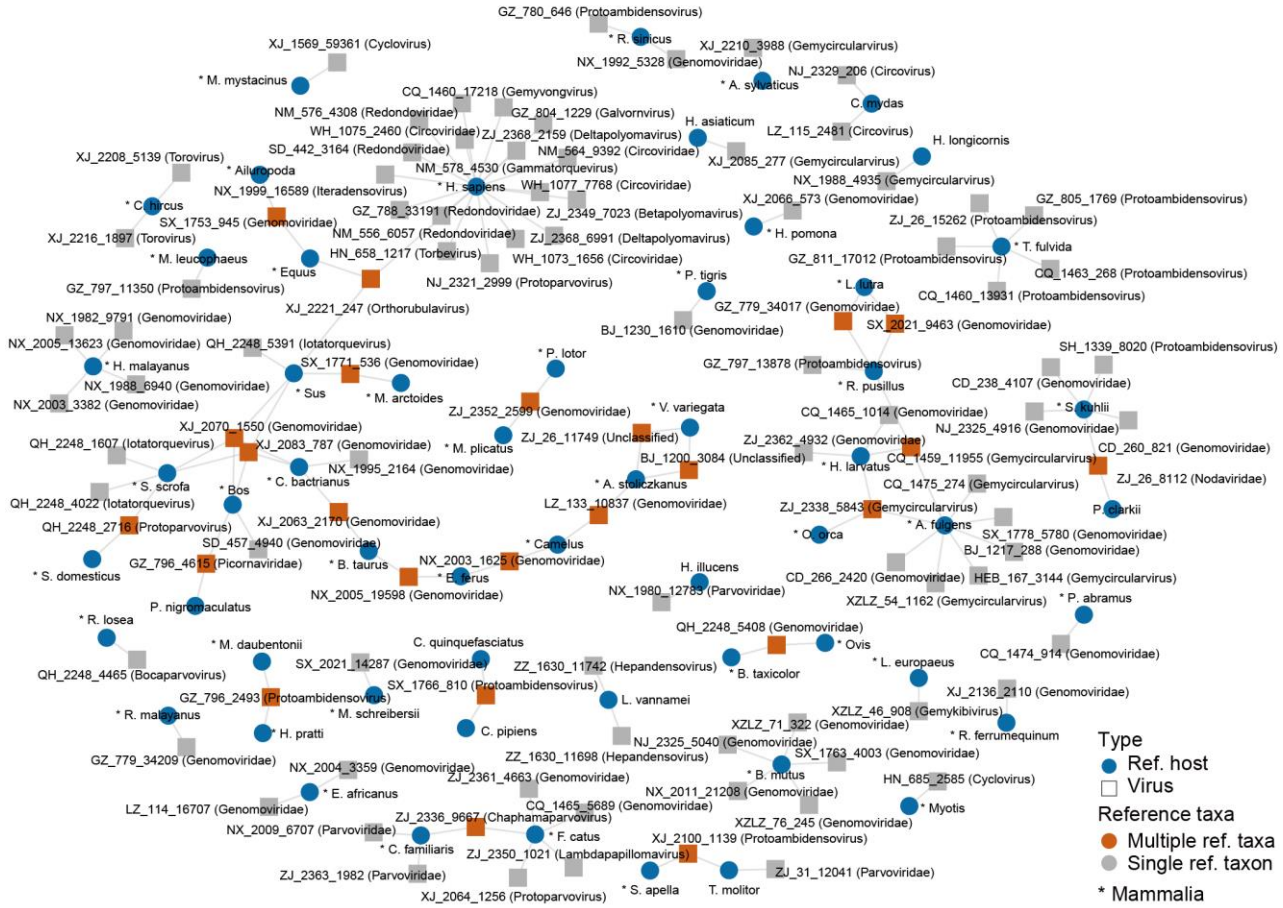
Supporting queries (association edges)
- 1
- 10
- 20
- 40

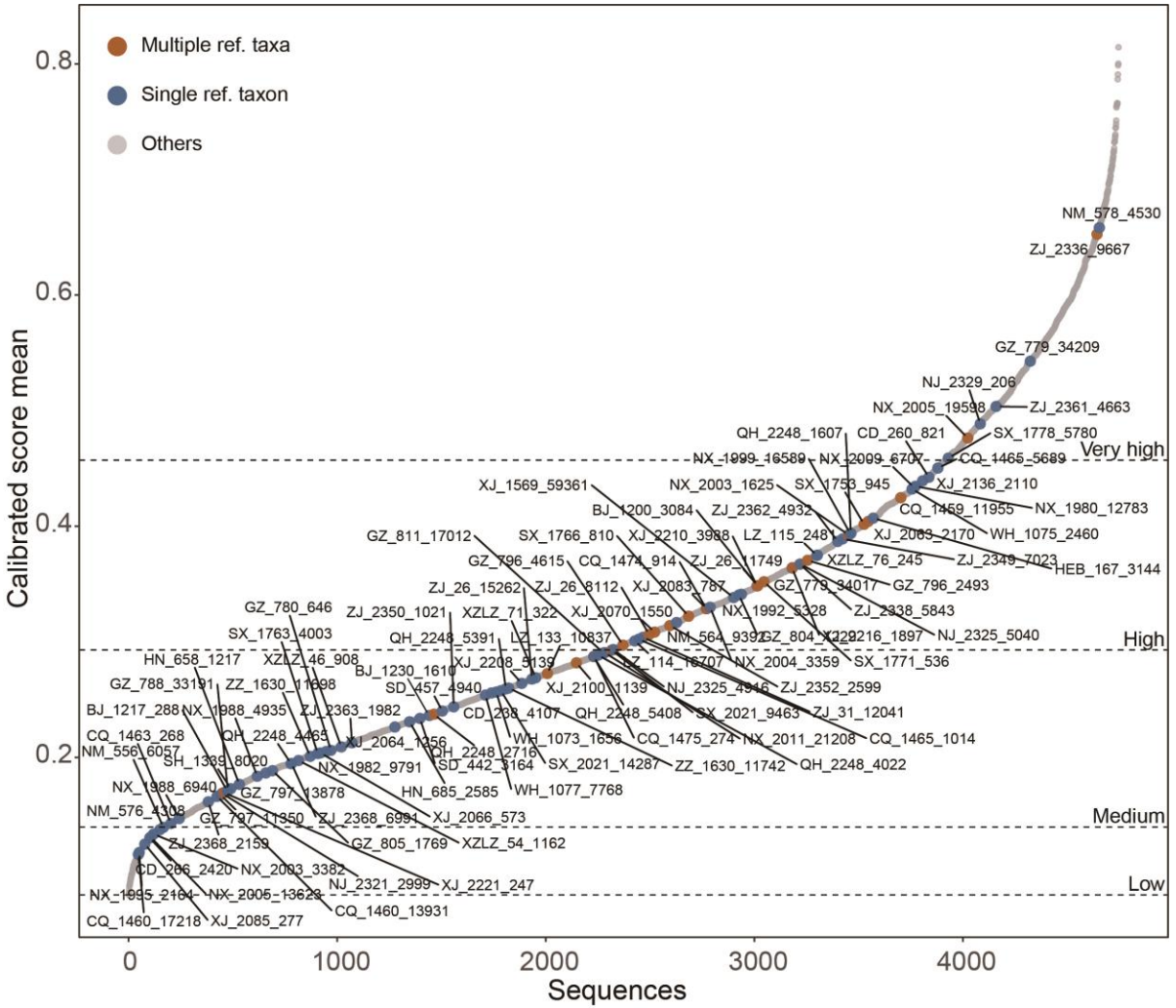
Reference-annotated host orders

Viral genera	Chiroptera	Rodentia	Carnivora	Artiodactyla	Primates	Eulipotyphla	Perissodactyla	Dasyuromorphia	Lagomorpha	Testudines	Diptera	Ixodida	Lepidoptera	Hemiptera	Hymenoptera	Thysanoptera	Blattodea	Decapoda	Unionida	Spp.	Ord.	Human
Gemycircularvirus	●	●	●	●		●	●			●	●	●		●					●	23	11	
Protoambidensovirus	●				●						●		●							21	4	
Gemykibivirus	●	●	●	●	●				●					●		●				12	8	◆
Cyclovirus	●			●	●															12	3	◆
Bocaparvovirus		●	●	●																9	3	
Circovirus			●	●	●					●		●								6	5	
Gemykrogvirus	●									●				●						6	3	
Brevihamaparvovirus											●									5	1	
Protoparvovirus			●	●	●															4	3	◆
Torovirus				●				●												3	2	
Felismacovirus			●	●																2	2	
Gemyduguivirus		●												●						2	2	
Gemygorvirus	●				●															2	2	◆
Gemykroznavirus	●	●																		2	2	
Chaphamaparvovirus			●																	2	1	
Dependoparvovirus		●																		2	1	
Iotatorquevirus				●																2	1	

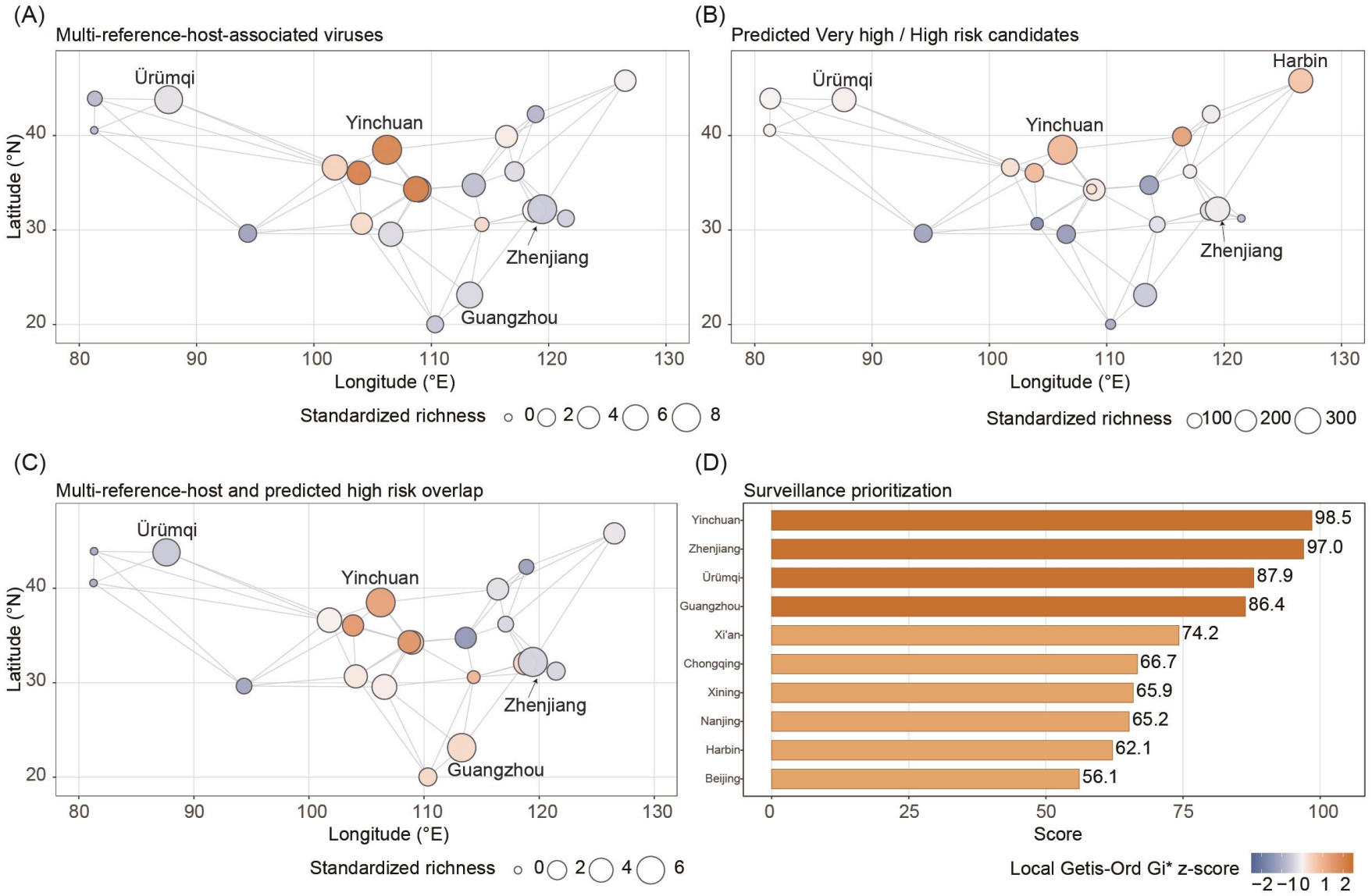
Circle size ● 1 ● 3 ● 7 ● 14

Sequence similarity associations with reference-annotated hosts

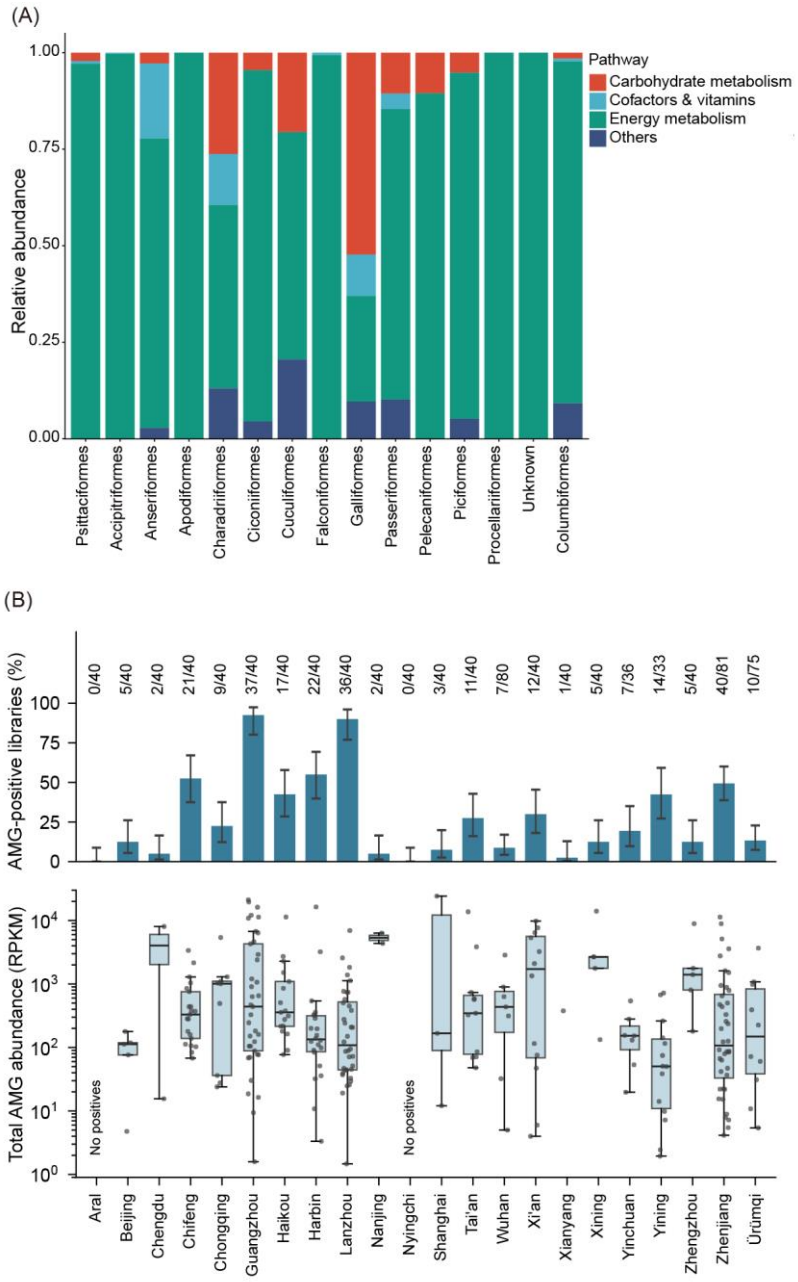


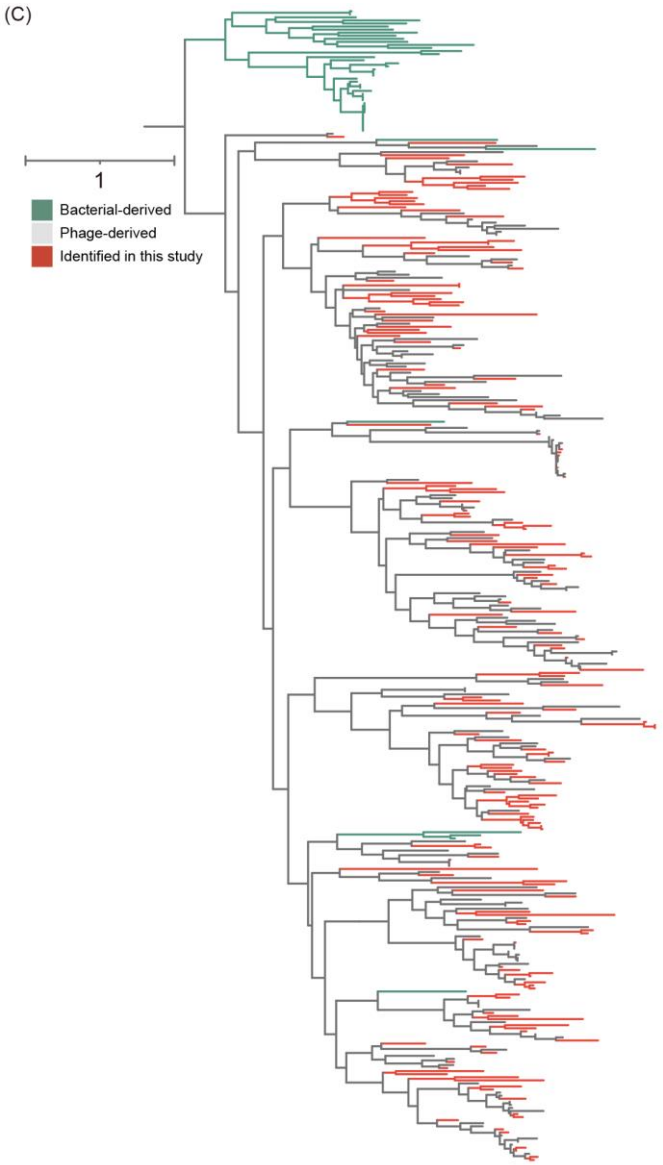


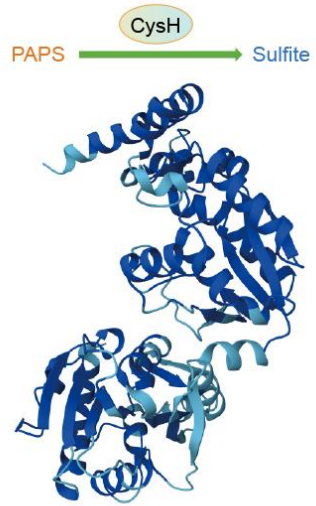
Sequence similarity associations with reference-annotated hosts



Nationwide patterns of AMGs in urban birds







Summary

01 **Revealed extensive and previously underexplored viral diversity in urban birds.**

Metaviromic analysis of 985 bird fecal samples from 22 cities across China identified 52,314 vOTUs. Many viral sequences showed substantial genetic divergence from known references, expanding the sequence resources available for urban avian viromes.

02 **Revealed a spatial distribution pattern of urban avian viromes characterized by both cross-city sharing and local variation.**

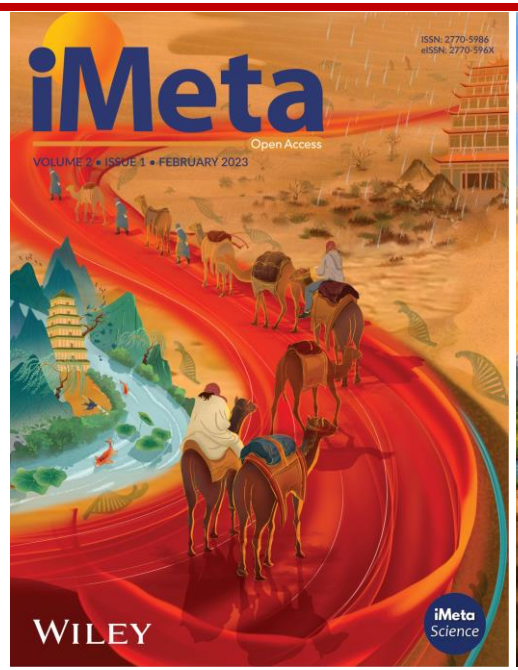
Viral richness and community composition varied markedly among cities, with phage richness showing a wider range of variation. Some viral lineages were widely distributed across multiple cities, whereas others exhibited more geographically restricted distribution patterns.

03 **Identified host-associated viral signals of potential public health relevance and functional insights into phages.**

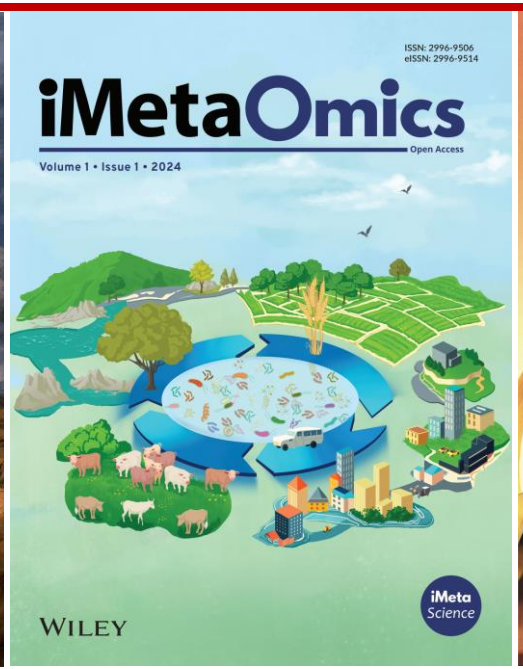
Viral sequence comparisons identified candidate viruses genetically related to reference sequences from humans and other animals. In addition, phage AMGs, particularly CysH, were identified, providing clues for future viral surveillance, validation of host associations, and functional studies.

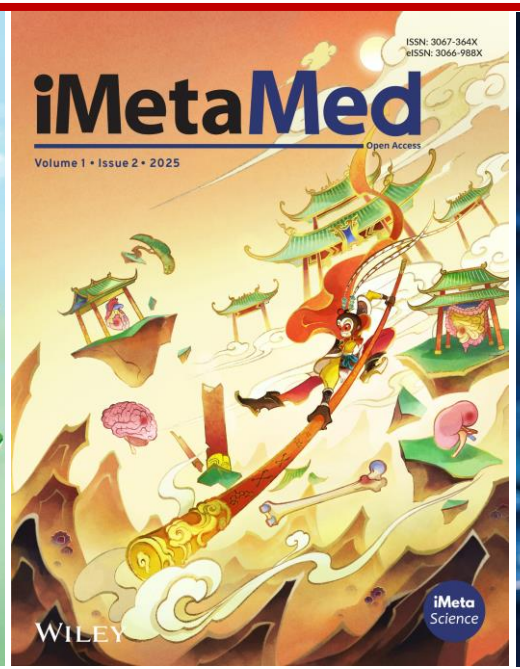
iMeta: Biology and Medicine in Info and Meta Era

WILEY











"***iMeta***" launched in 2022, impact factor (IF) **44.4**, ranking top 47/22643 in the world. It aims to publish innovative and high-quality papers with broad and diverse audiences. Its scope is similar to *Cell*, *Nature* and *Science*. Its unique features include video abstract, bilingual publication, and social media with 800,000 followers. Indexed by **SCIE/ESI**, **PubMed**, **Google Scholar** etc.

"***iMetaOmics***" launched in 2024, indexed by **ESCI**, **PubMed**, with a **target IF>15, and its scope is similar to** *Nature Communications*, *Science Advances*, *Advanced Science*, *Nucleic Acids Research*, etc.

"***iMetaMed***" launched in 2025, with a target IF>15, similar to *Med, Cell Reports Medicine, eBioMedicine, eClinicalMedicine* etc.

"***iMetaBio***" launched in 2026, with a target IF>15, similar to *Cell Reports, Cell Reports Medicine, eBioMedicine, eClinicalMedicine*

Society: http://www.imeta.science

Publisher: https://wileyonlinelibrary.com/journal/imeta

Submission: iMeta: https://wiley.atyponrex.com/journal/IMT2
iMetaOmics: https://wiley.atyponrex.com/journal/IMO2
iMetaMed: https://wiley.atyponrex.com/journal/IMM3

iMetaScience

iMetaScience

office@imeta.science
imetaomics@imeta.science

Promotion Video

Update
2026/10/19