



**MINISTÈRE
DE LA SANTÉ PUBLIQUE,
HYGIÈNE ET PRÉVENTION**



Latest insights from intensive mpox genomic surveillance in DRC

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Recherches TRANSlationnelles sur le VIH et les Maladies Infectieuses (TransVIHMI), UM/IRD/INSERM, Montpellier, France



International
Pathogen
Surveillance
Network

WHO hosted network

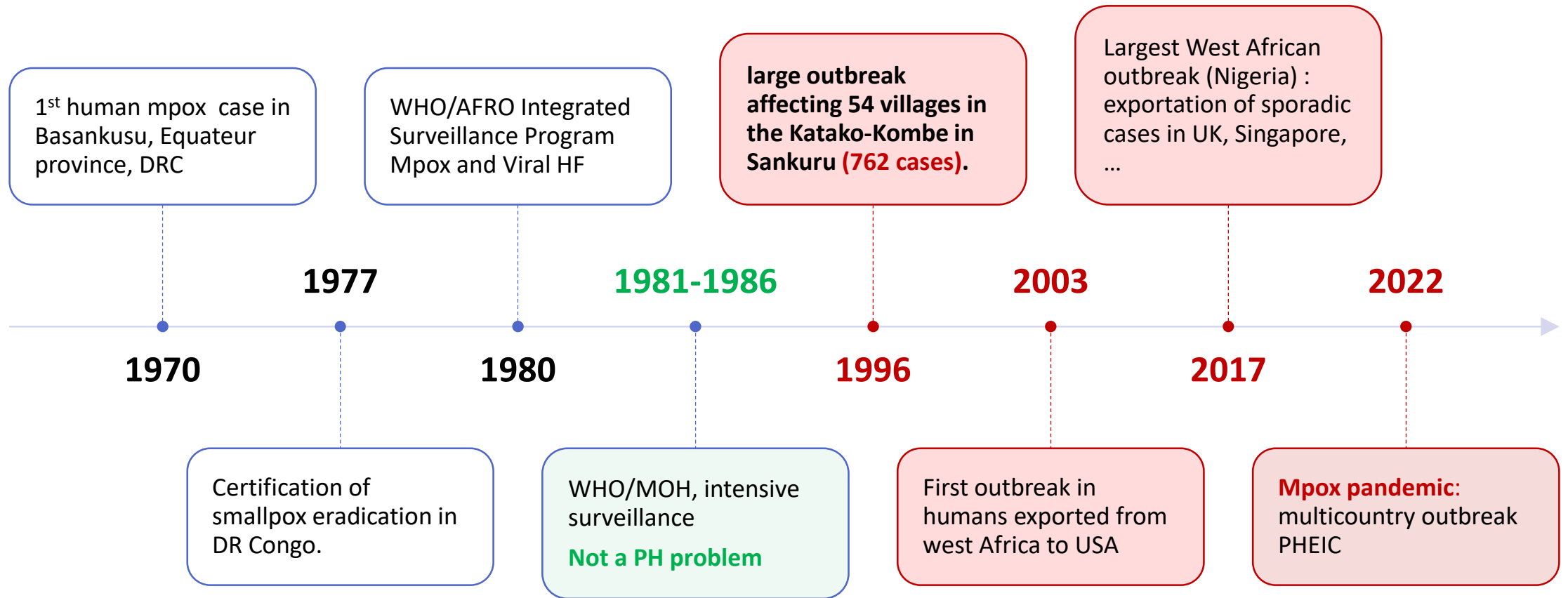


THE
TASK
FORCE
FOR
GLOBAL HEALTH

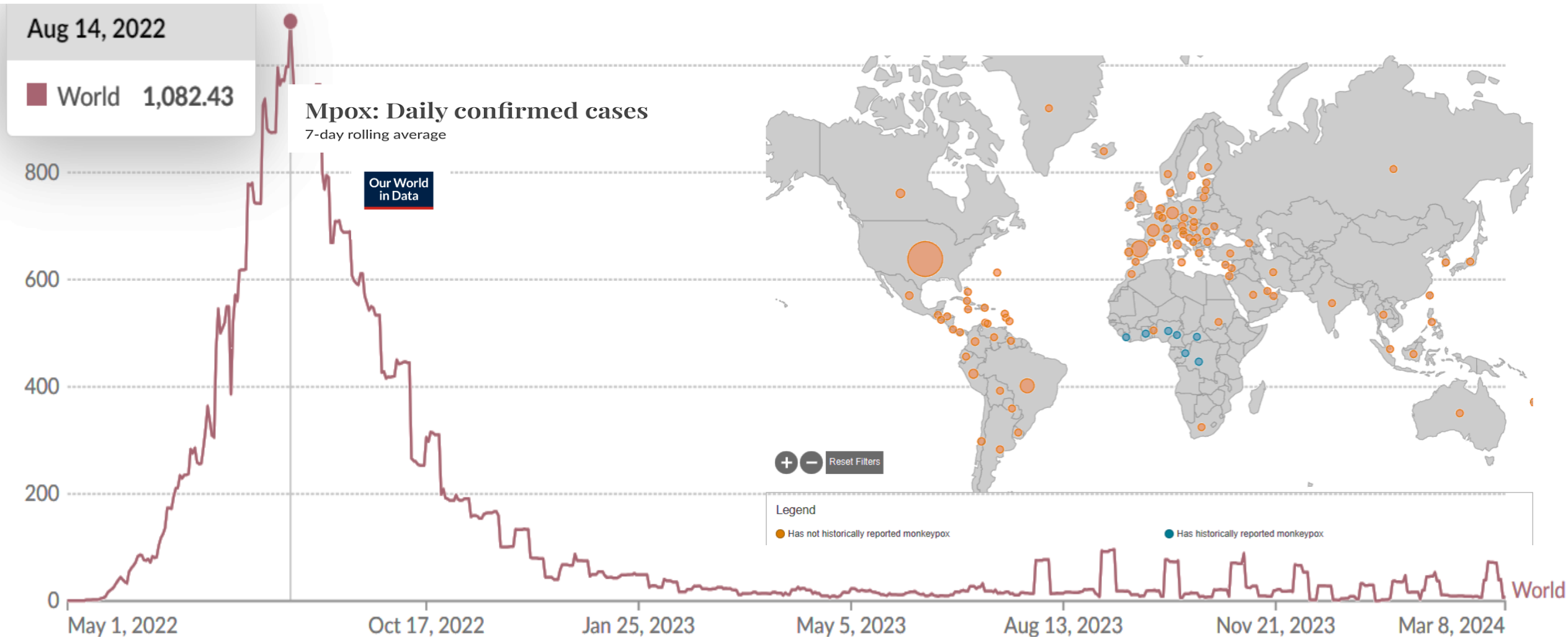
List of diseases under surveillance in the DRC

MALADIES	SEM 17			SEM 18			SEM 19			SEM 1 - 19 / 2024		
	CAS	DECES	LETALITE	CAS	DECES	LETALITE	CAS	DECES	LETALITE	CAS	DECES	LETALITE
CHOLERA	601	10	1,66%	659	6	0,91%	532	5	0,94%	16055	275	1,71%
COQUELUCHE	22	0	0,00%	22	0	0,00%	14	0	0,00%	292	0	0,00%
DECES MATERNELS		50		44			58			809		
DIARR SANGLANTE	894	1	0,11%	909	0	0,00%	701	0	0,00%	17069	10	0,06%
DIARRHEE DHY M5	17201	17	0,10%	16839	30	0,18%	18025	34	0,19%	304247	469	0,15%
DRACUNCULOSE	0	0	0,00%	0	0	0,00%	1	0	0,00%	2	0	0,00%
FIEVRE JAUNE	26	0	0,00%	49	0	0,00%	61	7	11,48%	590	25	4,24%
FIEVRE TYPHOIDE	39551	8	0,02%	38886	13	0,03%	38347	14	0,04%	751576	273	0,04%
GRIPPE	53647	2	0,00%	55258	2	0,00%	56050	4	0,01%	1052043	59	0,01%
IRA	106629	16	0,02%	109917	14	0,01%	110922	45	0,04%	2159257	446	0,02%
MENINGITE	88	10	10,20%	88	7	7,07%	110	10	9,09%	2187	182	8,32%
MONKEYPOX	257	5	1,95%	439	12	2,73%	521	14	2,69%	6872	363	5,28%
PALUDISME CONF	304802	243	0,08%	305544	233	0,08%	312869	253	0,08%	5904623	4658	0,08%
PALUDISME SUSP	453566	62	0,01%	462964	87	0,02%	457659	69	0,02%	8710829	1447	0,02%
PESTE	25	1	4,00%	5	0	0,00%	8	0	0,00%	354	8	2,26%
PFA	114	1	0,88%	69	0	0,00%	103	0	0,00%	1395	3	0,22%
RAGE	12	1	8,33%	15	0	0,00%	3	0	0,00%	156	10	6,41%
ROUGEOLE	1439	22	1,53%	1743	26	1,49%	1607	53	3,30%	45935	1071	2,33%
TNN	14	7	50,00%	12	4	33,33%	16	6	37,50%	198	87	43,94%

Mpox on the list of reportable disease since 1996



1st PHEIC in 2022



Among benefits : Intensive sequencing

Sequence Type

2
RefSeq Nucleotides

1,178,143
All Proteins

7,558
All Nucleotides

375
RefSeq Proteins

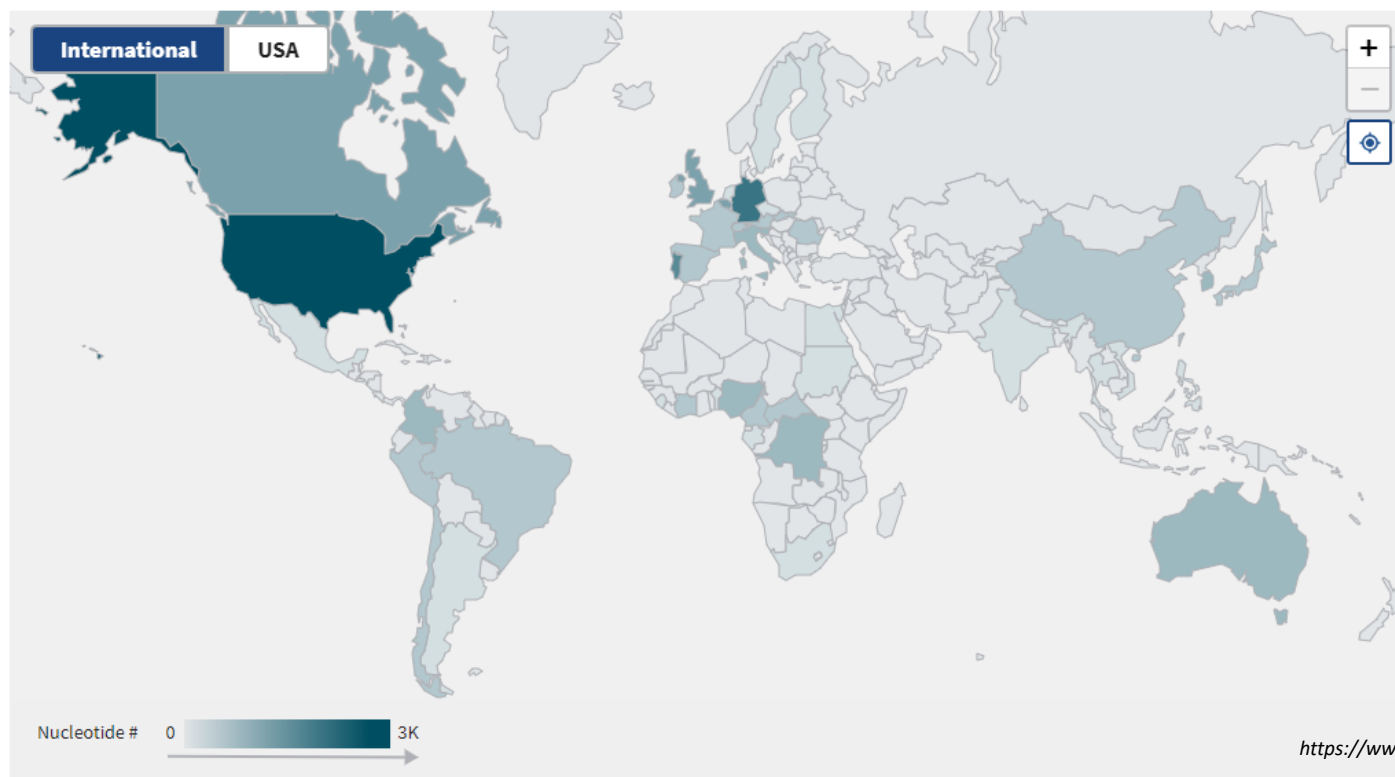
2,129
Complete Nucleotides

Genbank (NCBI virus)

Geographic and Time Distribution

Choose locations to select MPXV sequence records with that collection location. Use the sliders or click date columns to select MPXV records by their sample collection date and/or their GenBank release date.

Geographic Distribution



Collection Time

Yearly

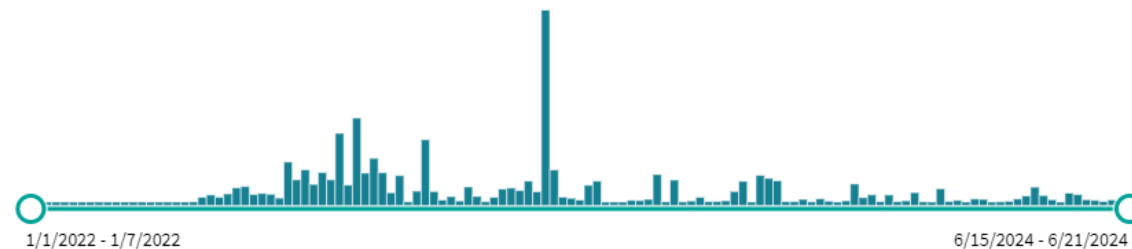
Reset



Release Time

Weekly

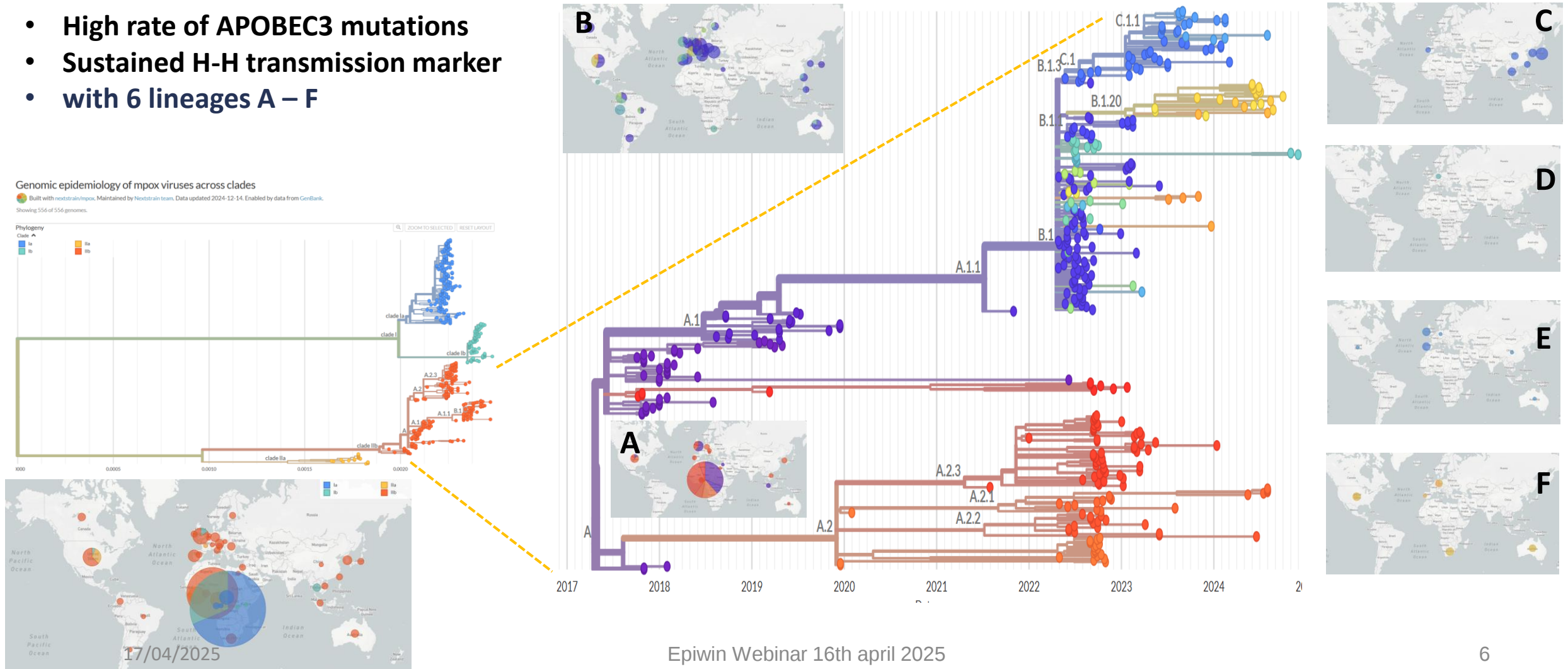
2022 - 2024



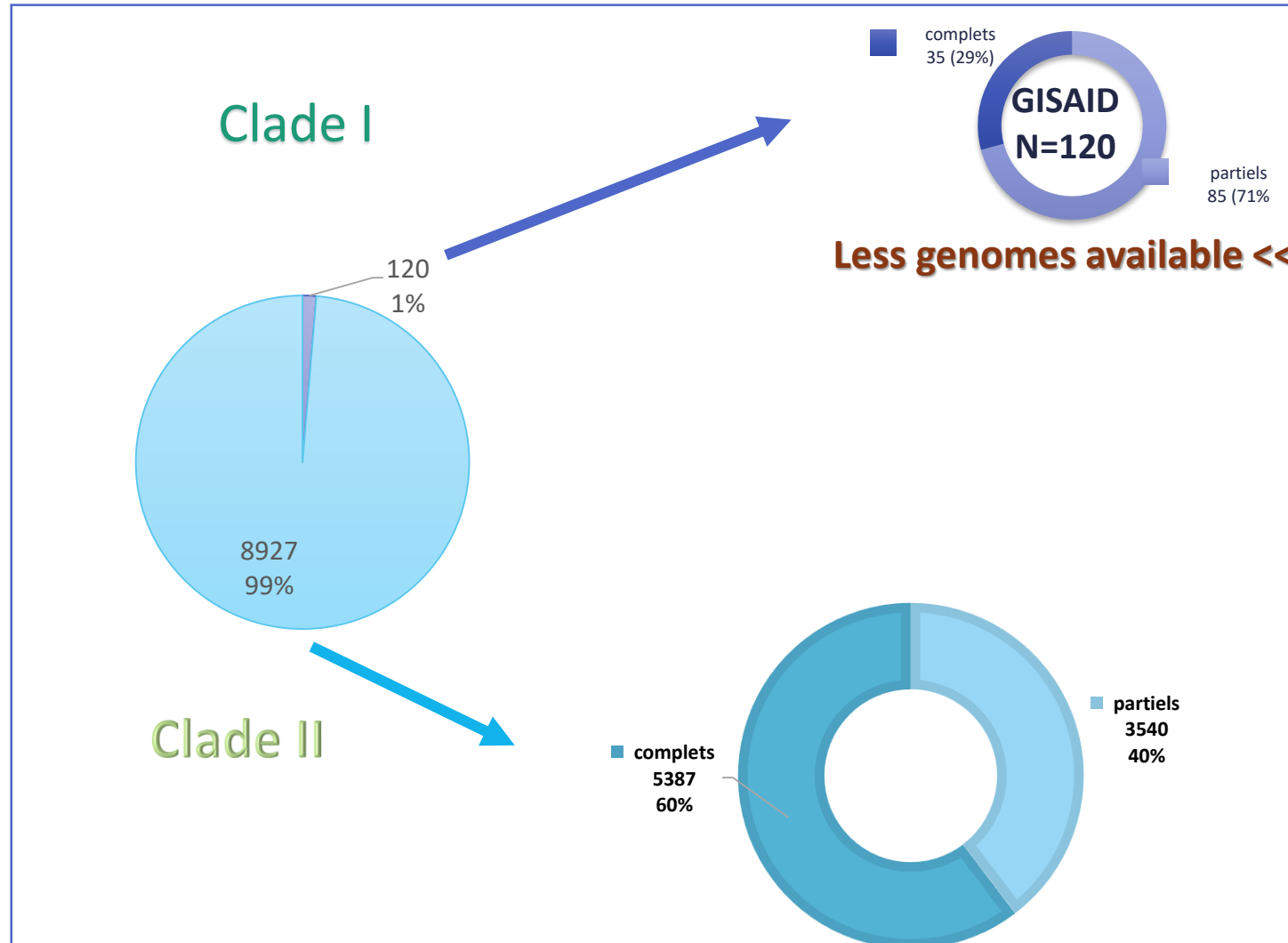
https://www.ncbi.nlm.nih.gov/labs/virus/vssi/#/dashboard?SeqType_s=Nucleotide&VirusLineage_ss=Monkeypox%20virus,%20taxid:10244

But more generated genomes were clade IIb

- High rate of APOBEC3 mutations
- Sustained H-H transmission marker
- with 6 lineages A – F



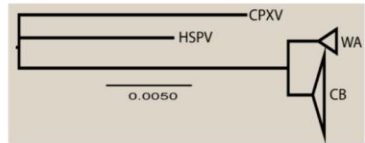
What about clade I ?



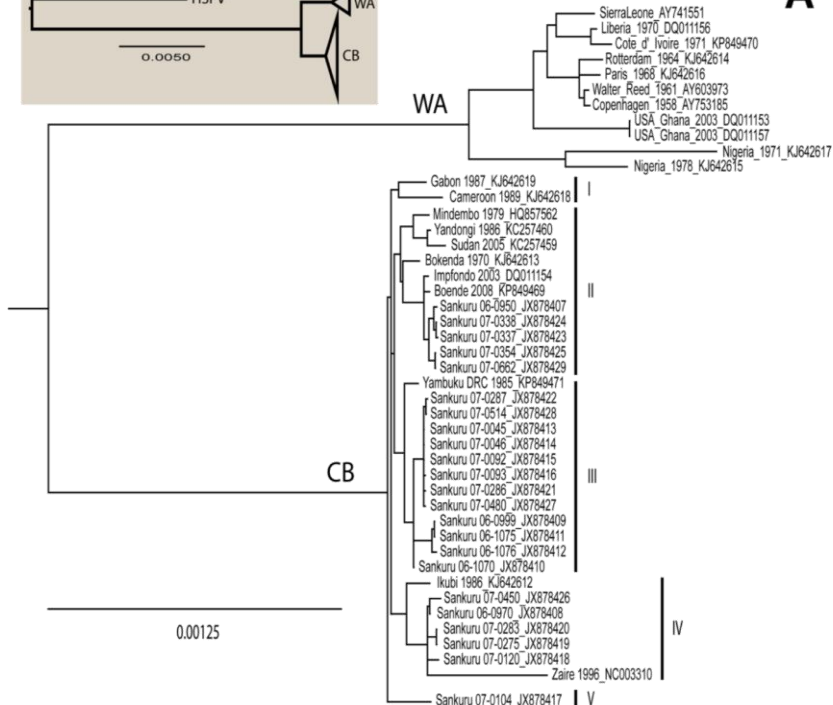
Less genomes available for clade I: 5 groups described

Viruses 2015, 7

2174



A



Nakazawa et al, 2015

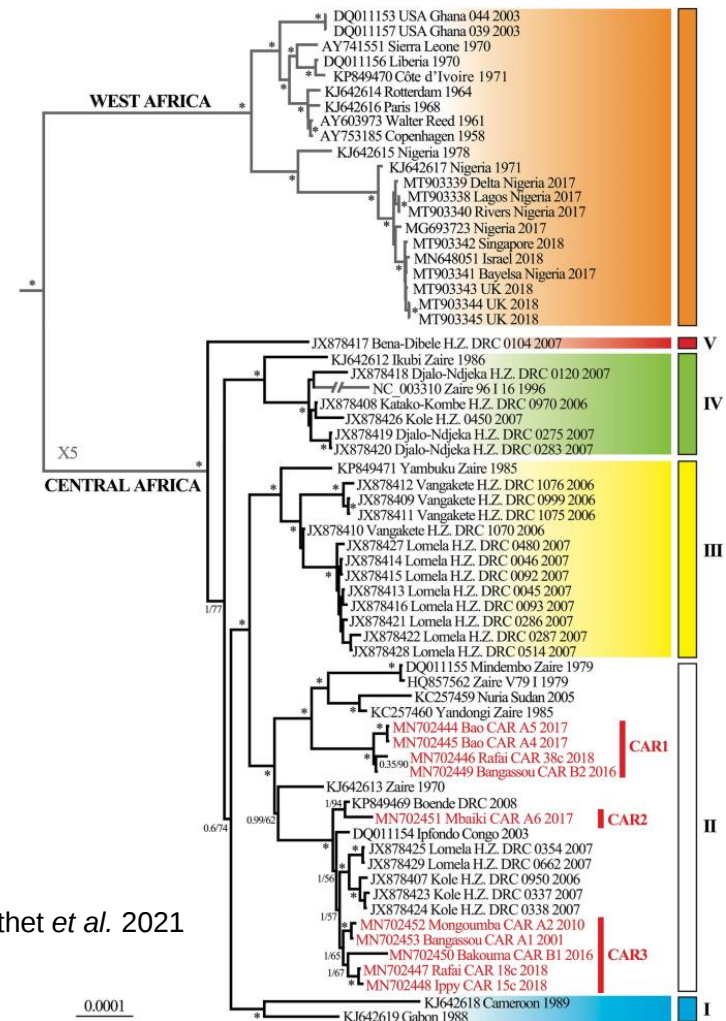
51 full genomes on
genbank

Westernmost GroupI
(Gabon and Cameroon)

Most diverse GroupII
(genomes from RC, CAR)

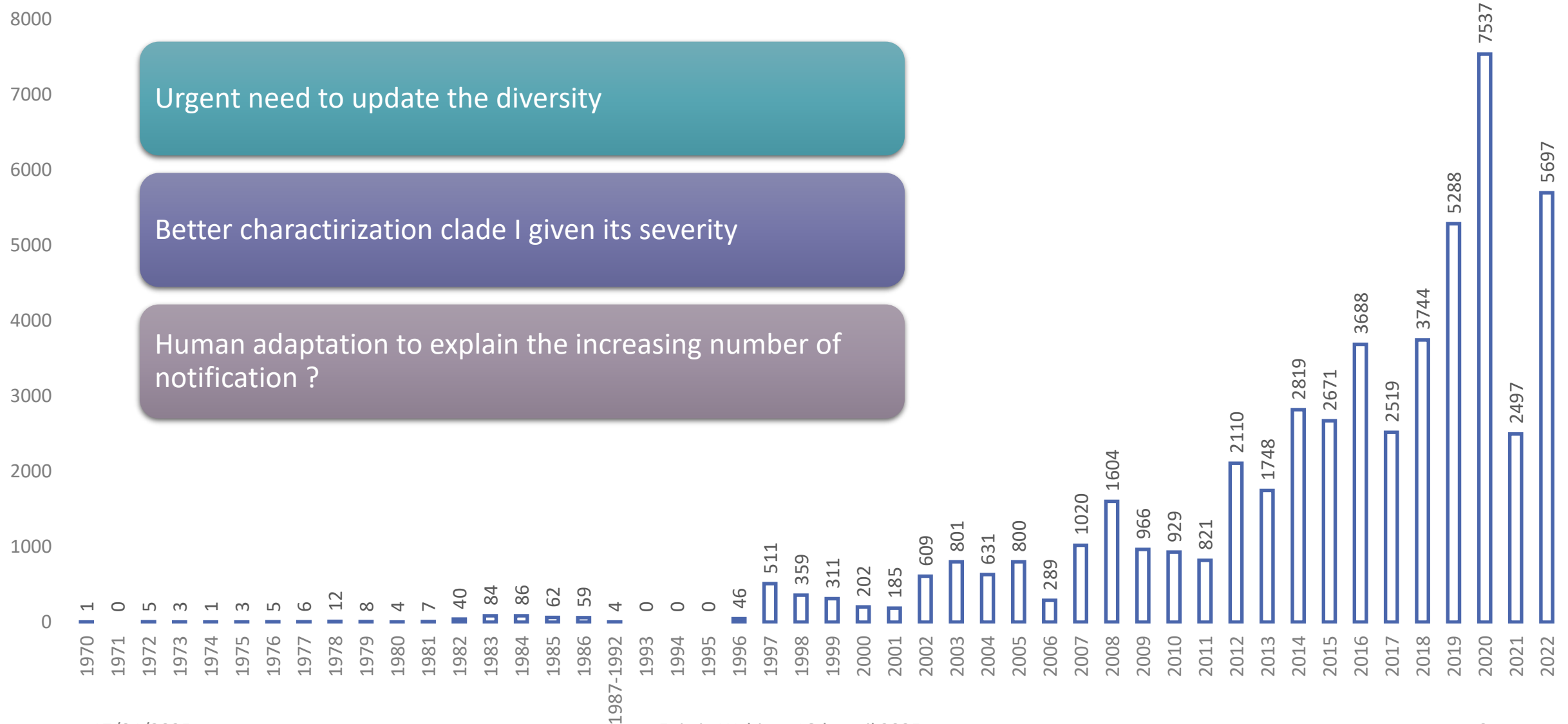
from 5 provinces Maj.
of DRC strains (Sankuru)

Suggested zoonotic
transmission



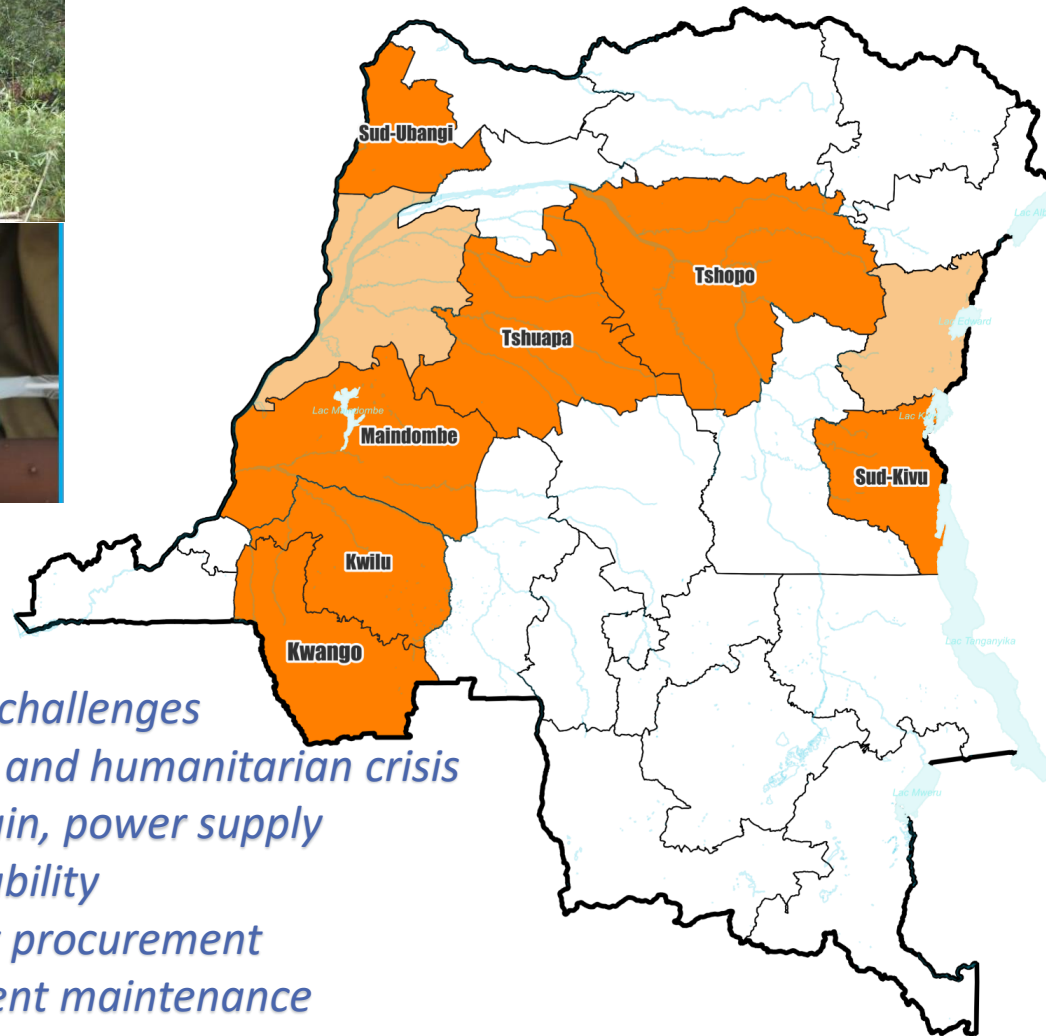
Berthet et al. 2021

Continued increasing trends through decades

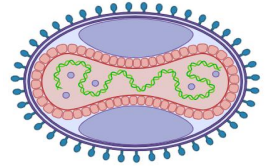


Multi-disciplinary team investigations despite challenges

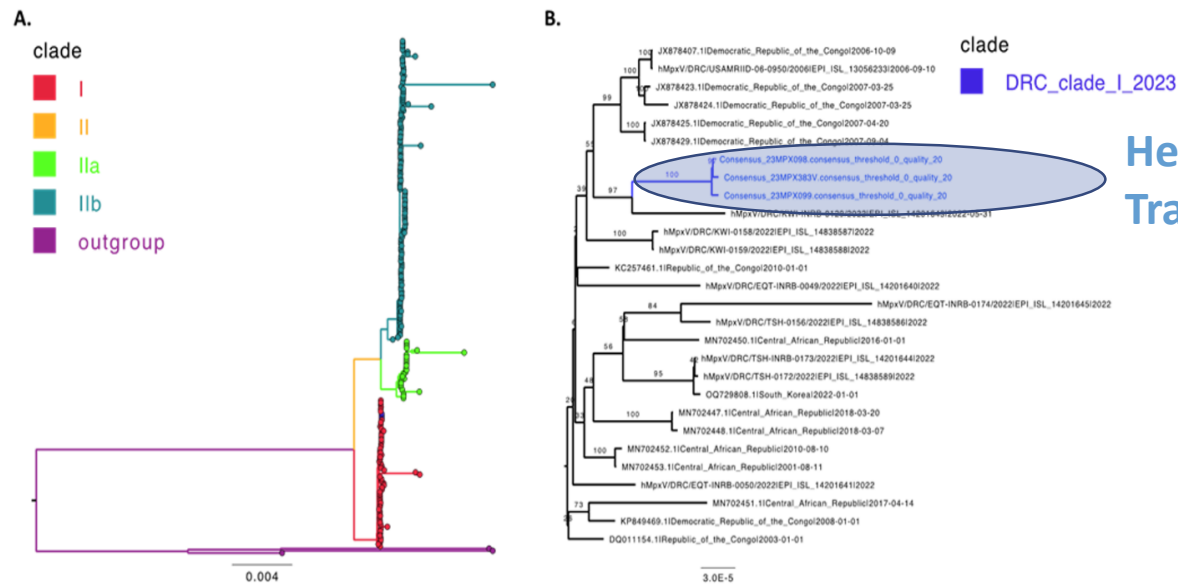
AFROSCREEN, MBOTE, IMREC, DTRA, Africa PGI, WHO...



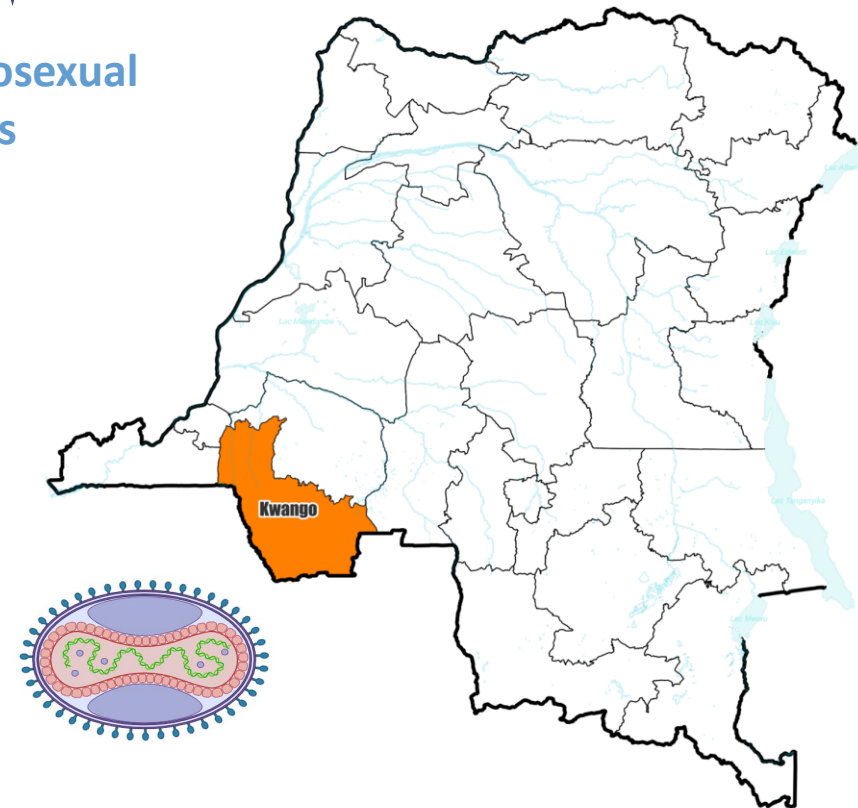
*Logistic challenges
Security and humanitarian crisis
Cold chain, power supply
Sustainability
Reagent procurement
Equipment maintenance*



MPXV clade I cases associated with sexual contact in DRC



Hetero/homosexual
Transmissions



EMERGING INFECTIOUS DISEASES®

ISSN: 1080-6059

EID Journal > Volume 30 > Early Release > Main Article

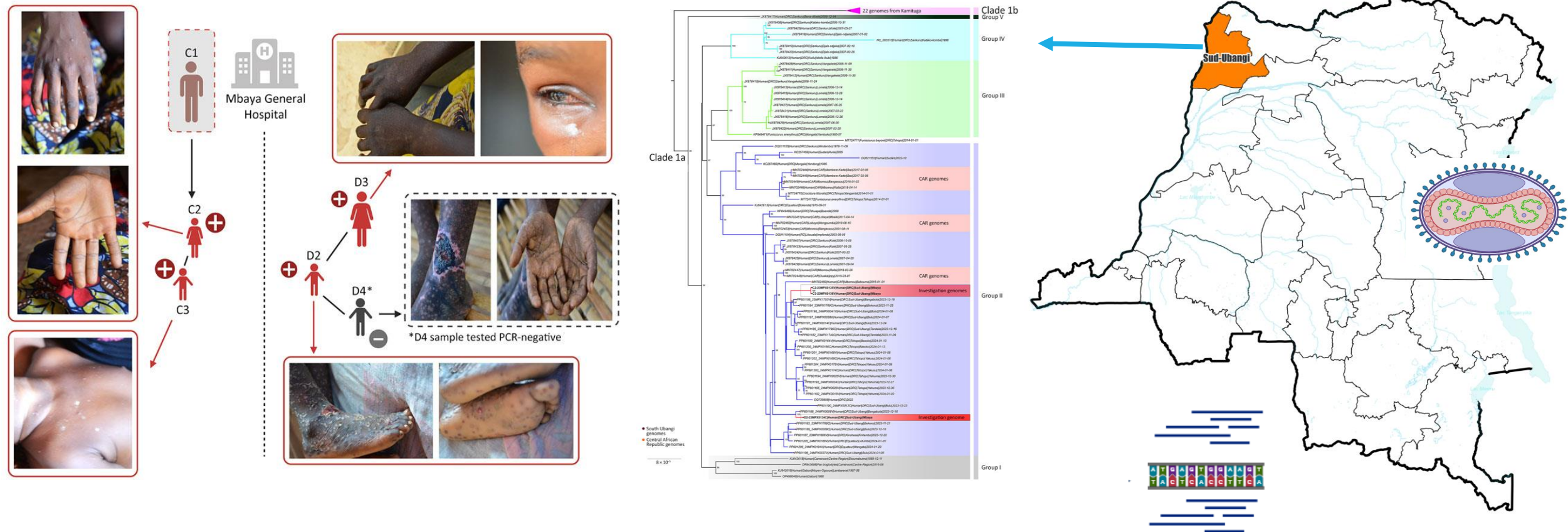
Disclaimer: Early release articles are not considered as final versions. Any changes will be reflected in the online version in the month the article is officially released.

Volume 30, Number 1—January 2024

Dispatch

Clade I-Associated Mpox Cases Associated with Sexual Contact, the Democratic Republic of the Congo

Probable cross-border transmission events of clade 1a between CAR and DRC



WHO alerts on Concerning epidemiology

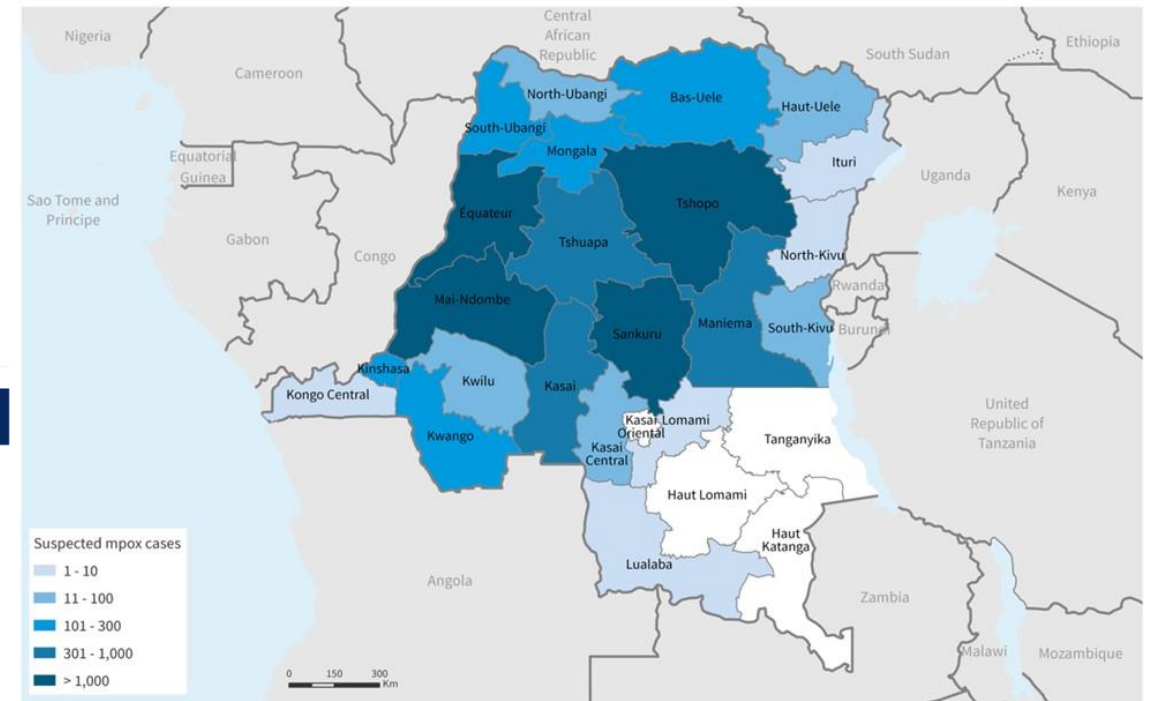
Disease Outbreak News

Mpox (monkeypox) - Democratic Republic of the Congo

23 November 2023

Situation at a glance

Mpox is an infectious disease caused by monkeypox virus (MPXV), which is endemic in densely forested regions of West, Central and East Africa, particularly in the northern and central regions of the Democratic Republic of the Congo. Eleven of the 26 provinces of the Democratic Republic of the Congo are identified as endemic for mpox, but in more recent years the total number of mpox cases and the number of provinces reporting mpox has been expanding, to 22 provinces as of November 2023. There are two known clades of MPXV: clade I, previously known as the Congo Basin clade; and clade II, previously called the West African clade; clade II further has two subclades: clade IIa and clade IIb. Before 2018, very few cases were reported outside of the African continent: eight international travellers returning from endemic countries and one outbreak related to imported animals. Since 2022, an epidemic of clade IIb MPXV has been ongoing globally,

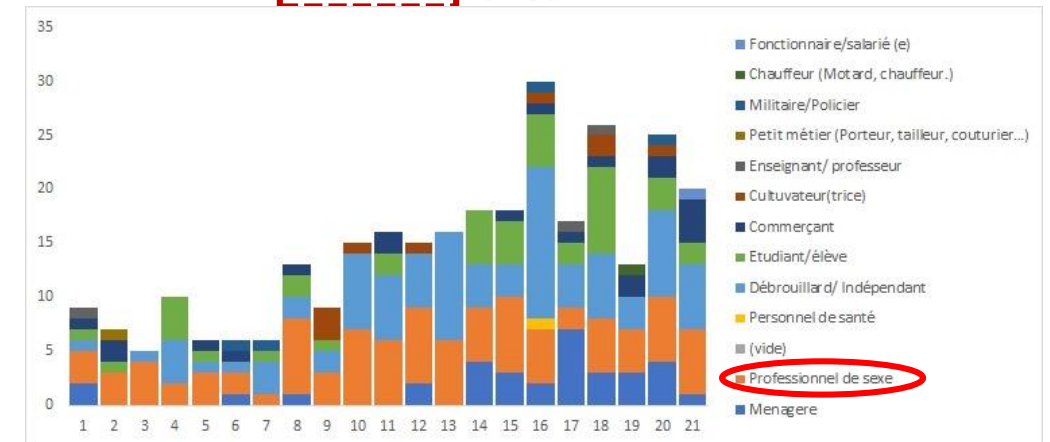
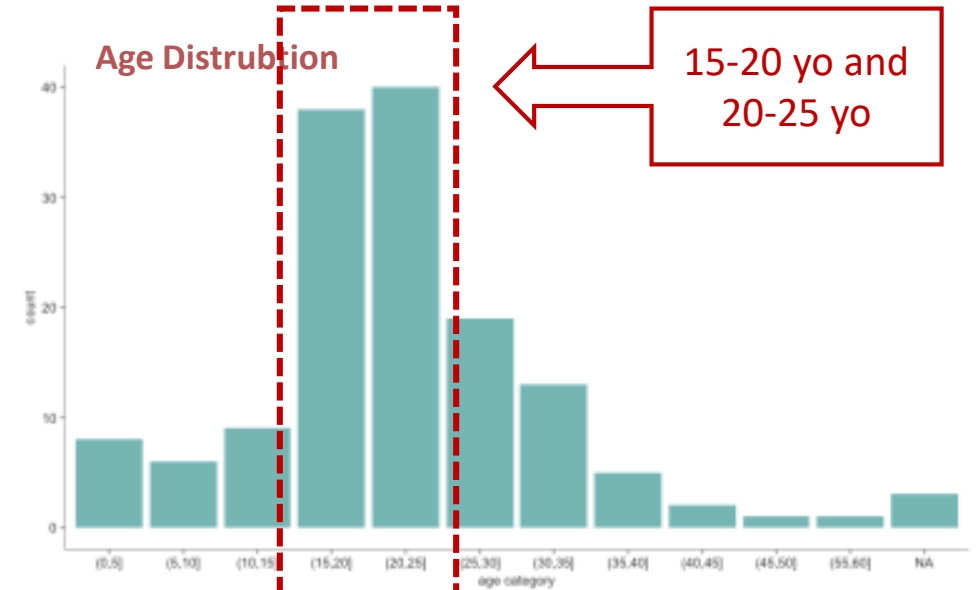


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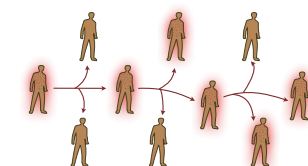
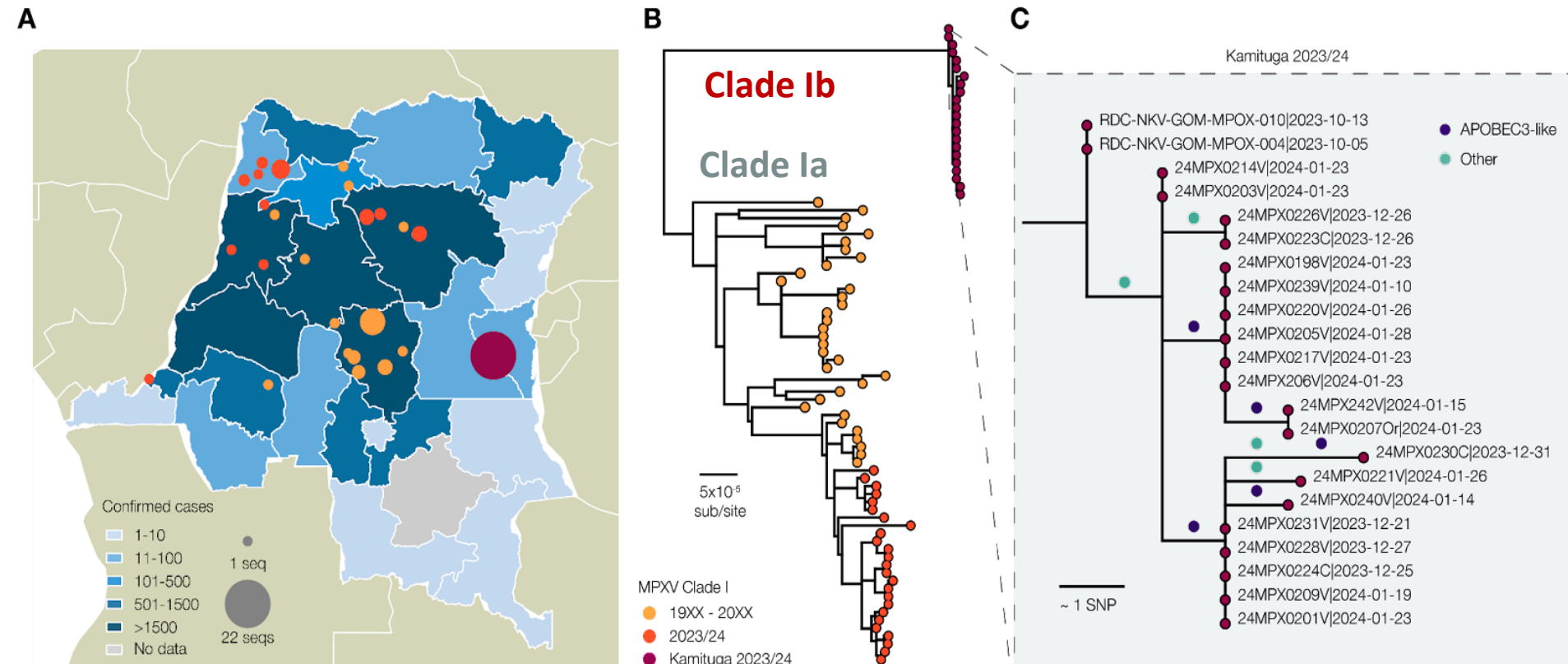
Data Source: World Health Organization, The Ministry of Public Health of the Democratic Republic of the Congo
Map Production: WHO Health Emergencies Programme
Map Date: 20 November 2023

 World Health Organization
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Emergence of Clade Ib in mining areas in specific clusters



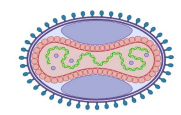
Sustained Human Outbreak of a New MPXV Clade I Lineage in the Eastern Democratic Republic of the Congo



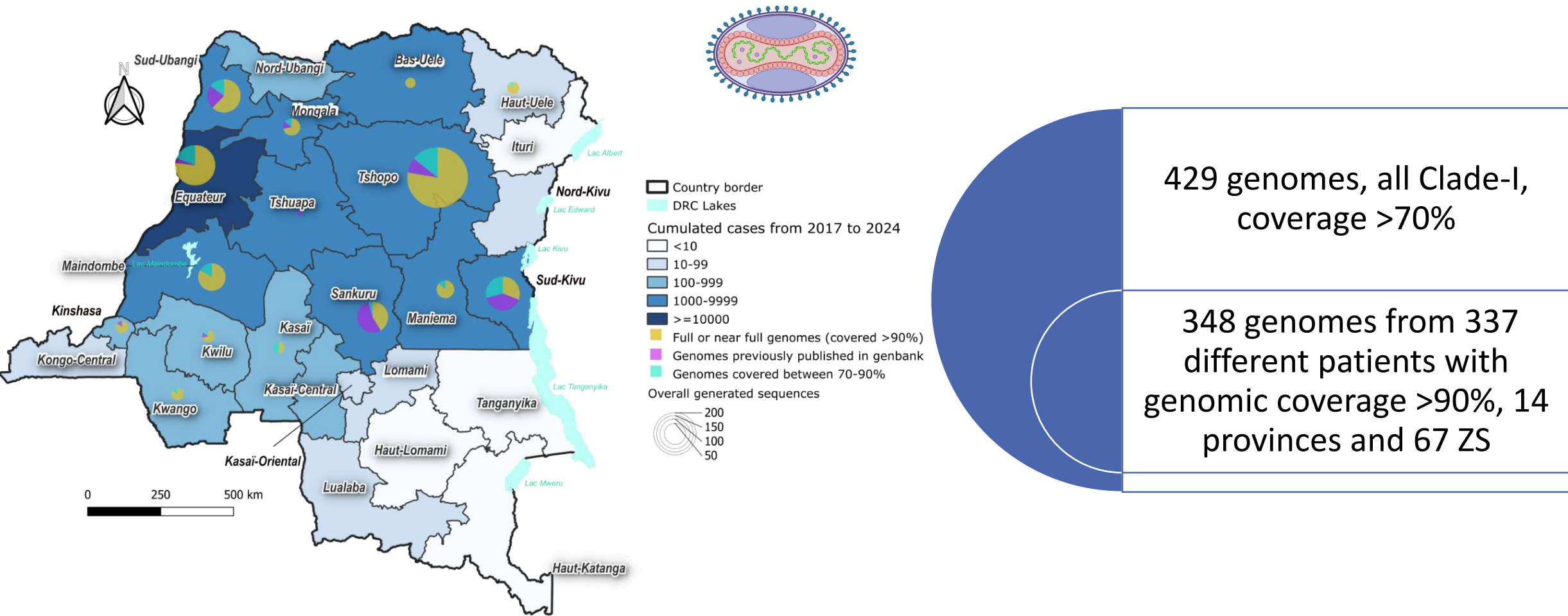
- ***New sh2023a outbreak***
- ***Sustained human-to-human transmission***
- ***Low diversity***
- ***Increased APOBEC3 mutation rate***
- ***Challenges for diagnosis***

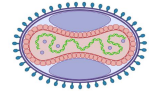


Clade Ia : high diversity

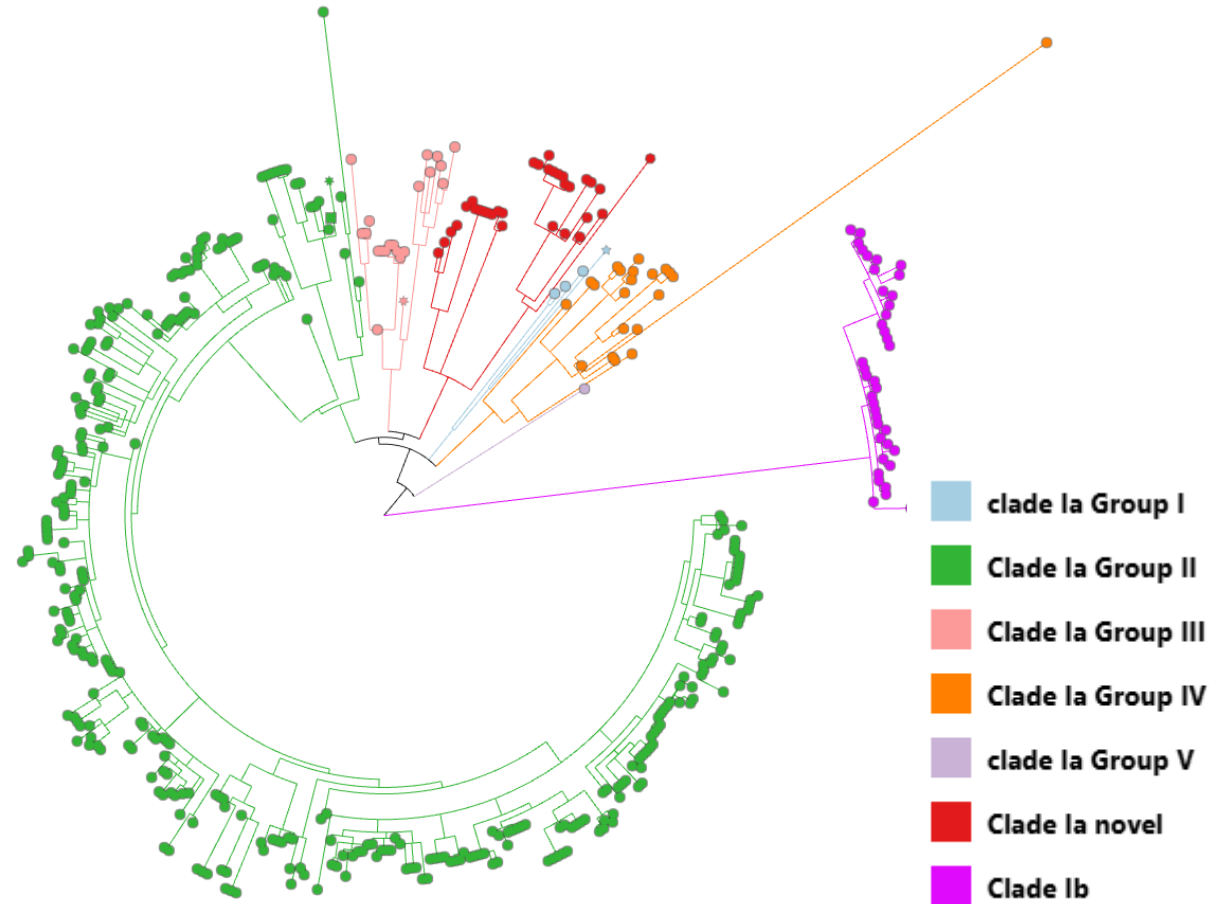
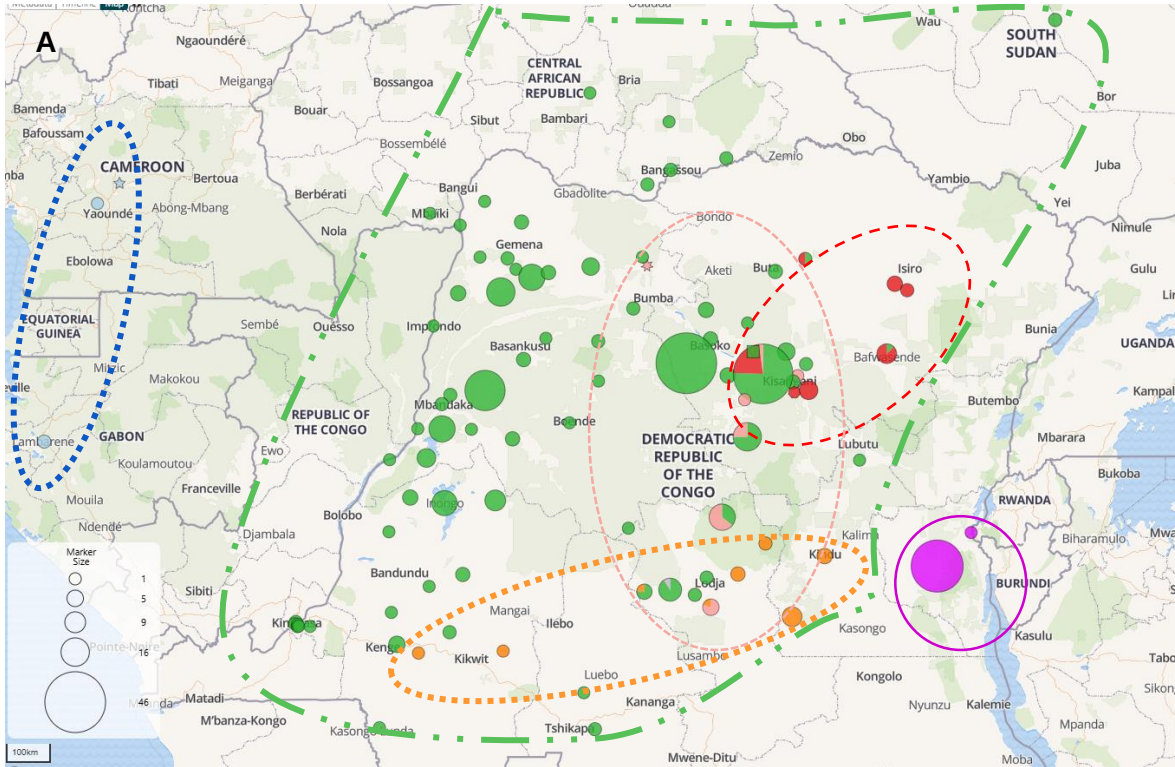


603 samples (581 patients) sequenced 2018-2024



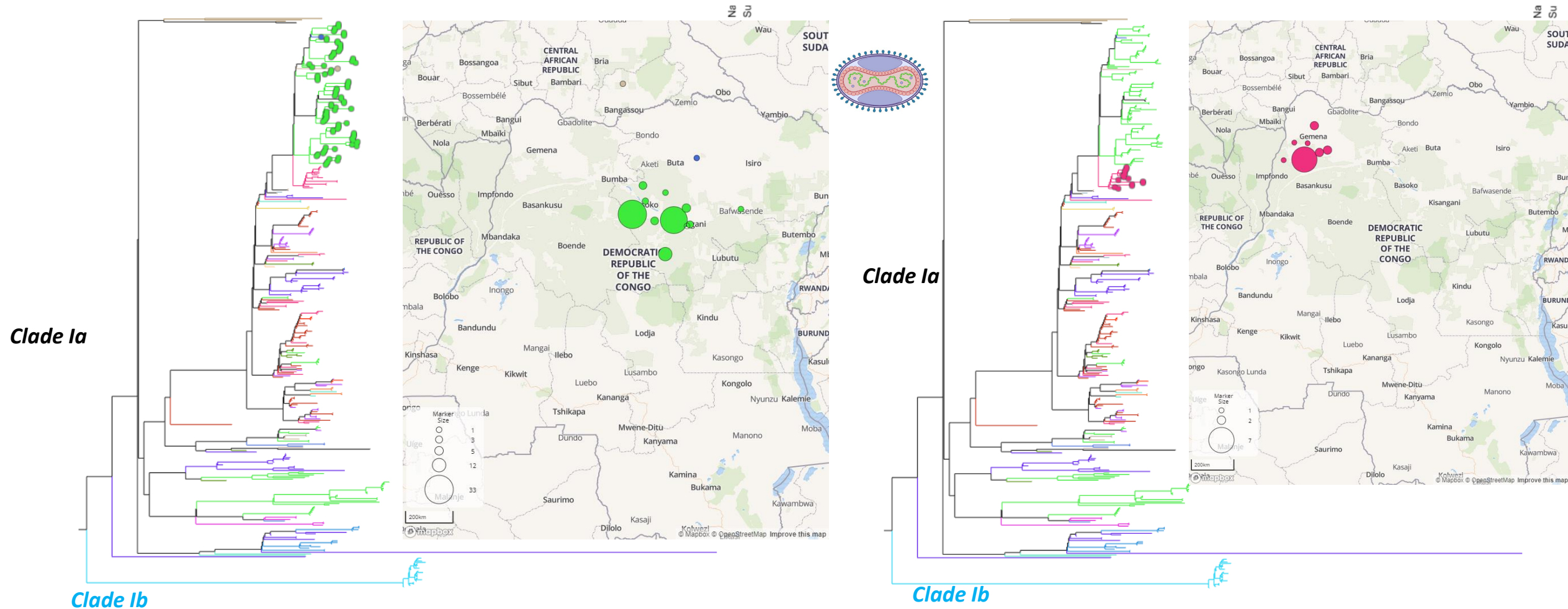


High diversity of mpox clade I in the DRC

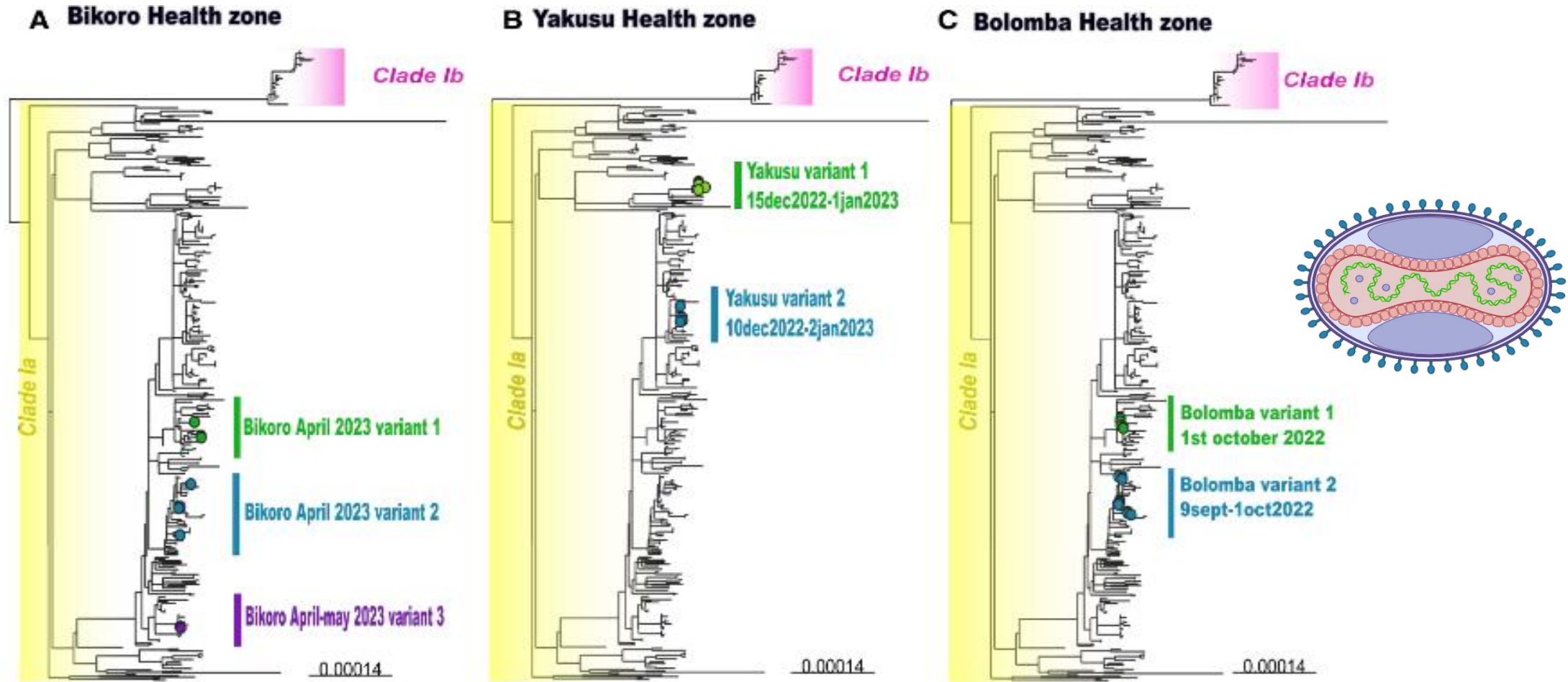


- Phylogeographic Clusters
 - **Cameroon and Gabon western (Group I)**
 - **Sankuru, Maniema and Kwilu most southern (savannah)**

Examples of phylogeographic clusters



Co-circulation of different variants



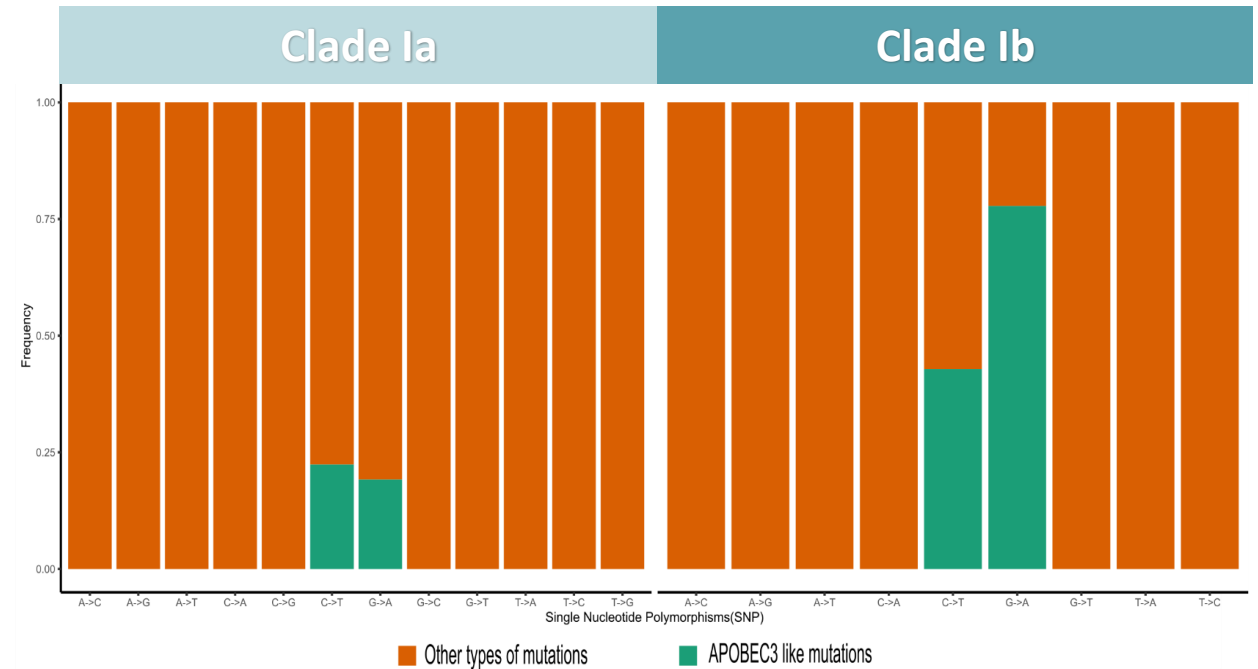
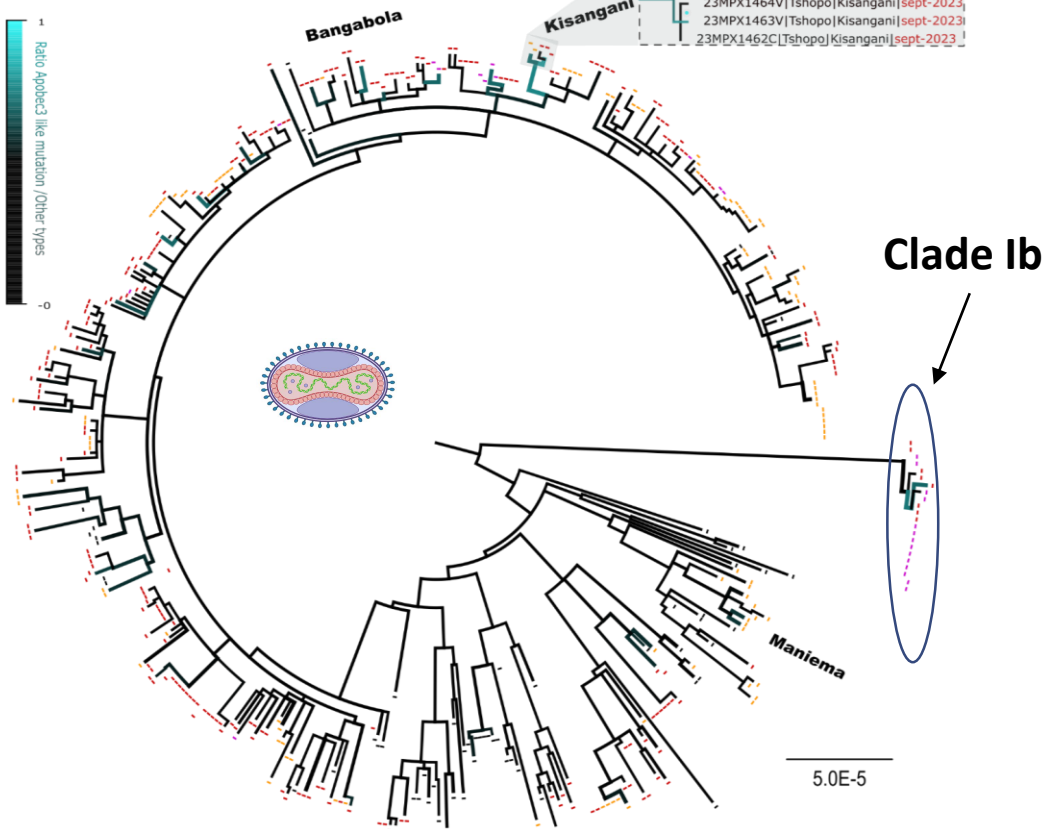
Predominance of zoonotic transmissions

Cell

Article

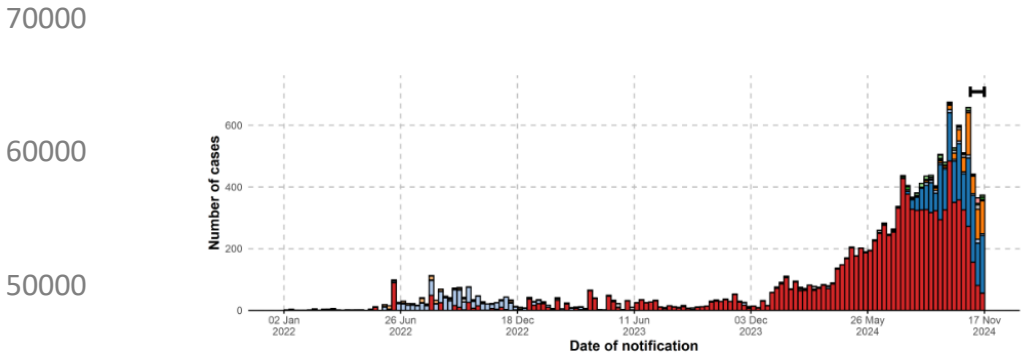
Clade I mpox virus genomic diversity in the Democratic Republic of the Congo, 2018–2024: Predominance of zoonotic transmission

• Apobec like mutations
• Other types



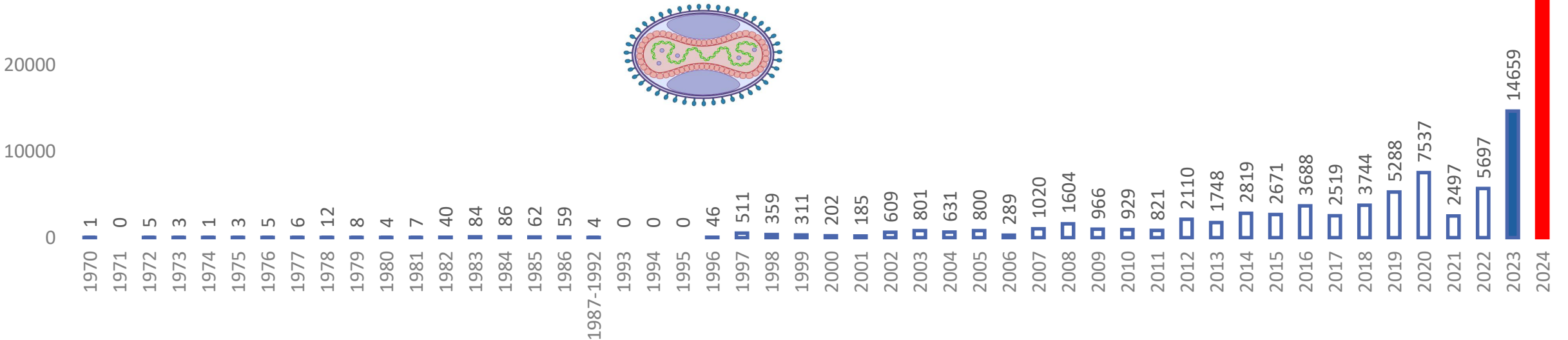
- Transmission zoonotique documentée pour le clade Ia
- Profil différent dans les clades Ia comparé au clade Ib qui a un taux élevé des mutations **de type APOBEC3**

Epidemiological situation still explosive in the DRC



In 2023: 14,659 suspected cases and 688 deaths (case fatality: 4.6%)

In 2024: 64,173 suspected cases, including 14053 confirmed cases



Double declaration of public health emergency



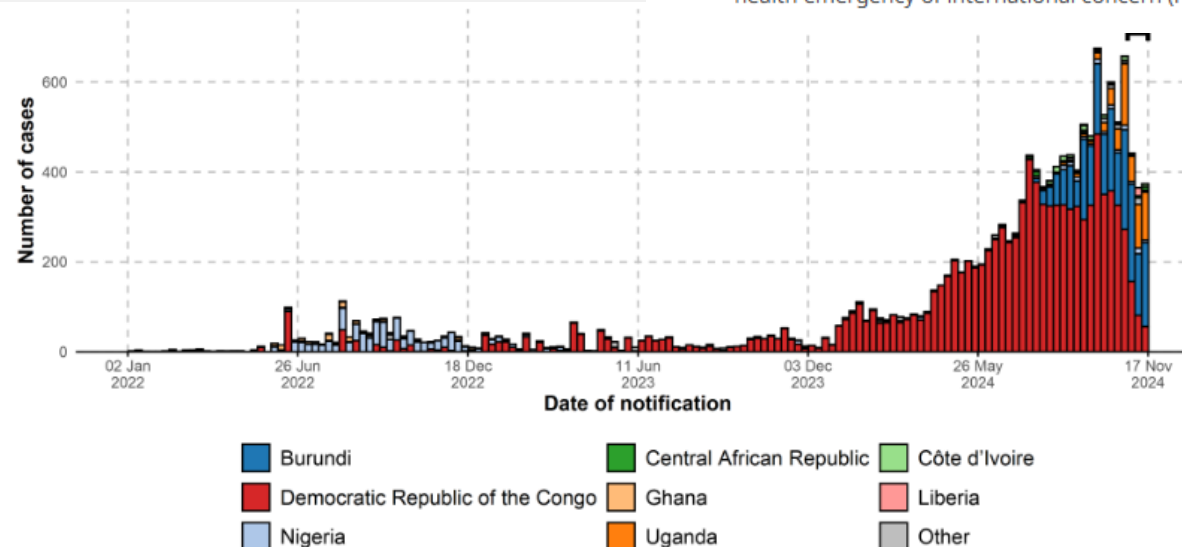
News / Articles

Mpox outbreaks in Africa constitute a public health emergency of continental security

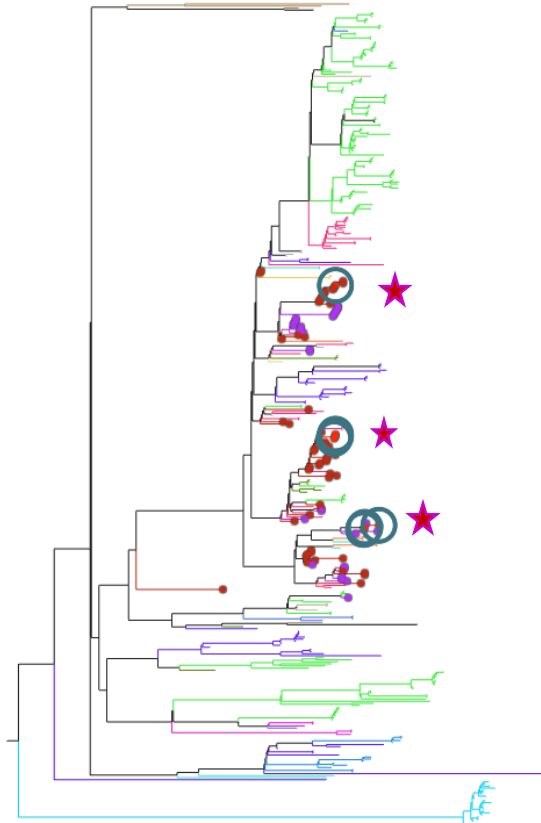
WHO Director-General declares mpox outbreak a public health emergency of international concern

14 August 2024 | News release | Reading time: 3 min (789 words)

WHO Director-General Dr Tedros Adhanom Ghebreyesus has determined that the upsurge of mpox in the Democratic Republic of the Congo (DRC) and a growing number of countries in Africa constitutes a public health emergency of international concern (PHEIC) under the International Health Regulations (2005) (IHR).



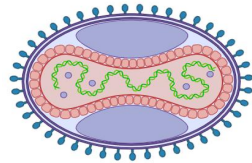
Documentation of clade Ia in Kinshasa, the capital, large urban city



❖ 3 identified clusters

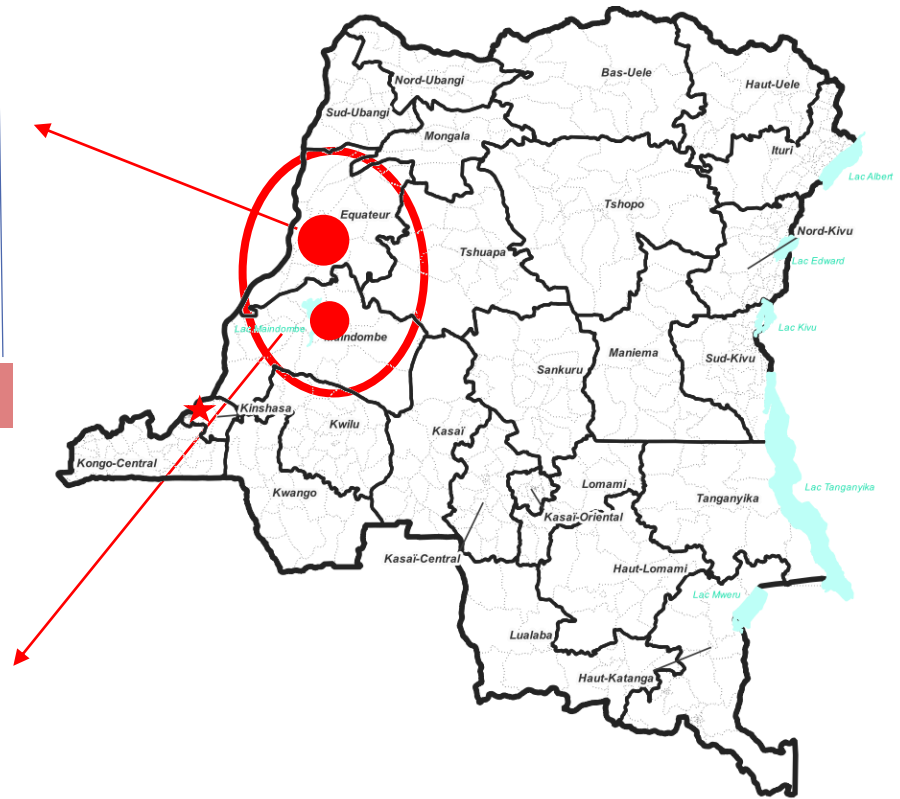
- 23MPX0278C|Homo_sapiens|DRC|Equateur|Bolomba|cz|2023-3-25
- 23MPX1190C|Homo_sapiens|DRC|Equateur|Djombo|cz|2023-8-12
- 23MPX1493S|Homo_sapiens|DRC|Equateur|Lotumbe|cz|2023-10-2
- 23MPX1495S|Homo_sapiens|DRC|Equateur|Lotumbe|cz|2023-10-3
- 23MPX1554V|Homo_sapiens|DRC|Kinshasa|Nsele|cz|2023-10-25
- 23MPX1529V|Homo_sapiens|DRC|Equateur|Basankusu|cz|2023-10-6
- 23MPX1093V|Homo_sapiens|DRC|Equateur|Basankusu|cz|2023-7-29
- 23MPX1073V|Homo_sapiens|DRC|Equateur|Bolomba|cz|2023-8-11
- 23MPX0493V|Homo_sapiens|DRC|Equateur|Bikoro|cz|2023-4-23
- 23MPX0492V|Homo_sapiens|DRC|Equateur|Bikoro|cz|2023-4-23
- 23MPX1064V|Homo_sapiens|DRC|Equateur|Bolomba|cz|2023-7-31
- 23MPX0878V|Homo_sapiens|DRC|Equateur|Bolomba|cz|2023-5-10

Introductions from Equateur



- 23MPX0228V|Homo_sapiens|DRC|Mai-ndombe|Inongo|cz|2023-2-20
- 23MPX1143C|Homo_sapiens|DRC|Kinshasa|Gombe|cz|2023-8-18
- 23MPX1289V|Homo_sapiens|DRC|Kinshasa|Matete|cz|2023-9-8
- 23MPX1143V|Homo_sapiens|DRC|Kinshasa|Gombe|cz|2023-8-18
- 23MPX0475C|Homo_sapiens|DRC|Mai-ndombe|Mushie|cz|2023-4-22
- 23MPX1229V|Homo_sapiens|DRC|Mai-ndombe|Kiriri|cz|2023-8-23

Introductions from Maindome



Introductions in Kinshasa through traffic on Congo River since août 2023

Kinshasa outbreaks

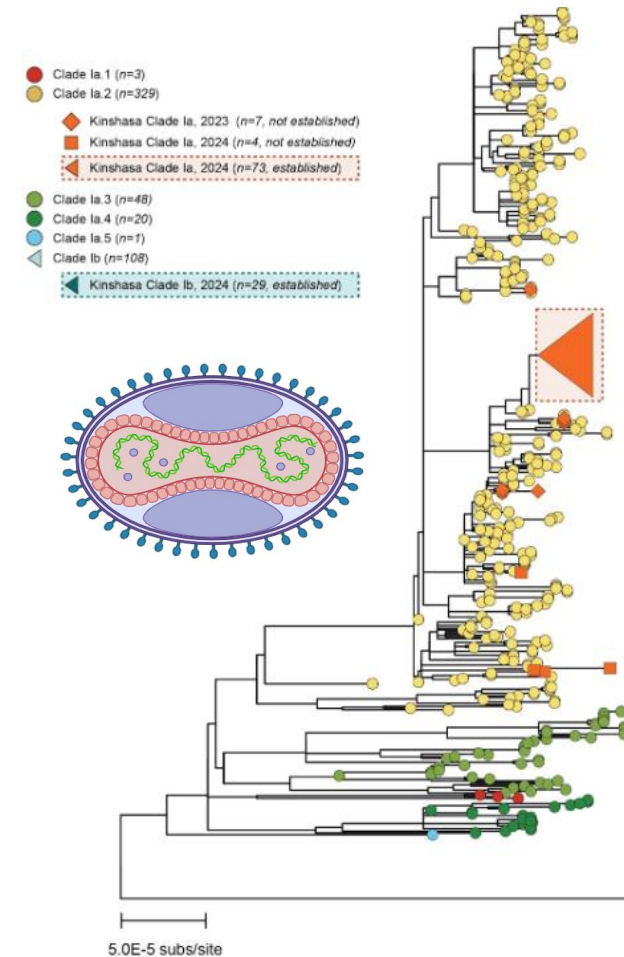
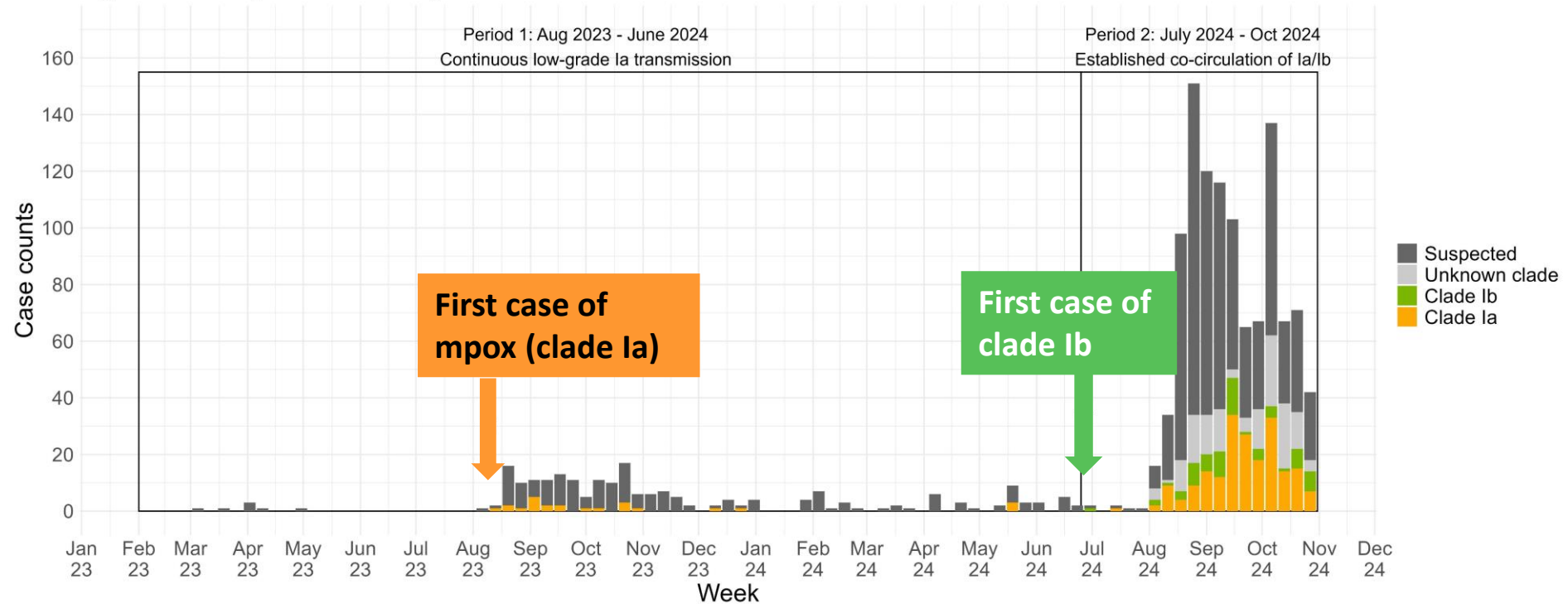
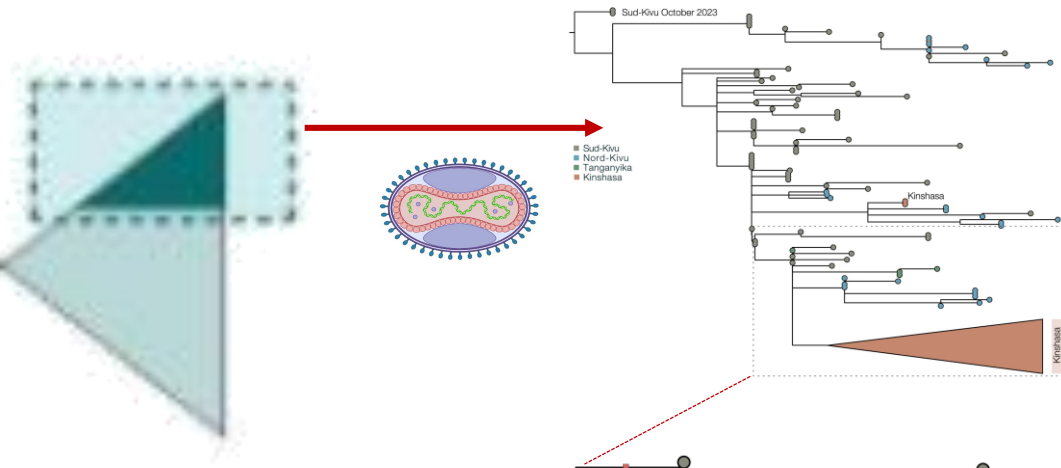


Figure 1: Weekly Case Counts by Clade

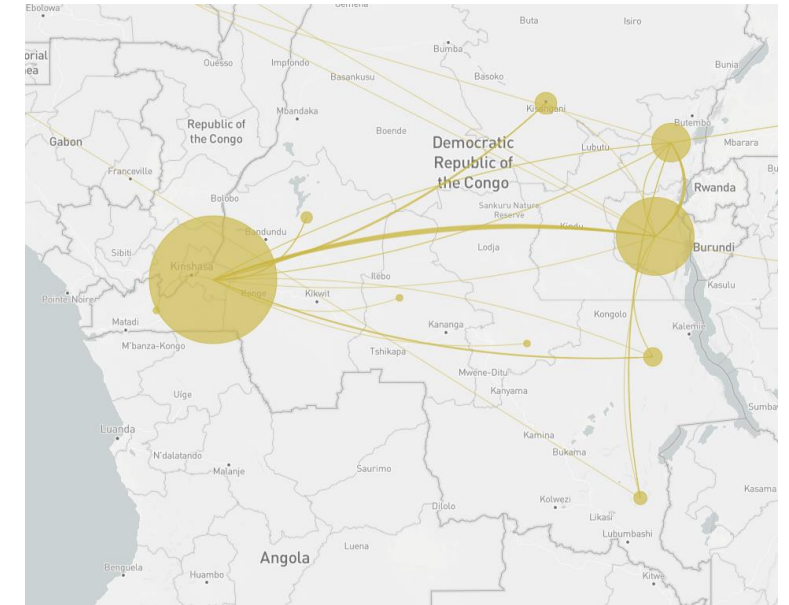


Clade Ib outbreak in Kinshasa with introductions and exports

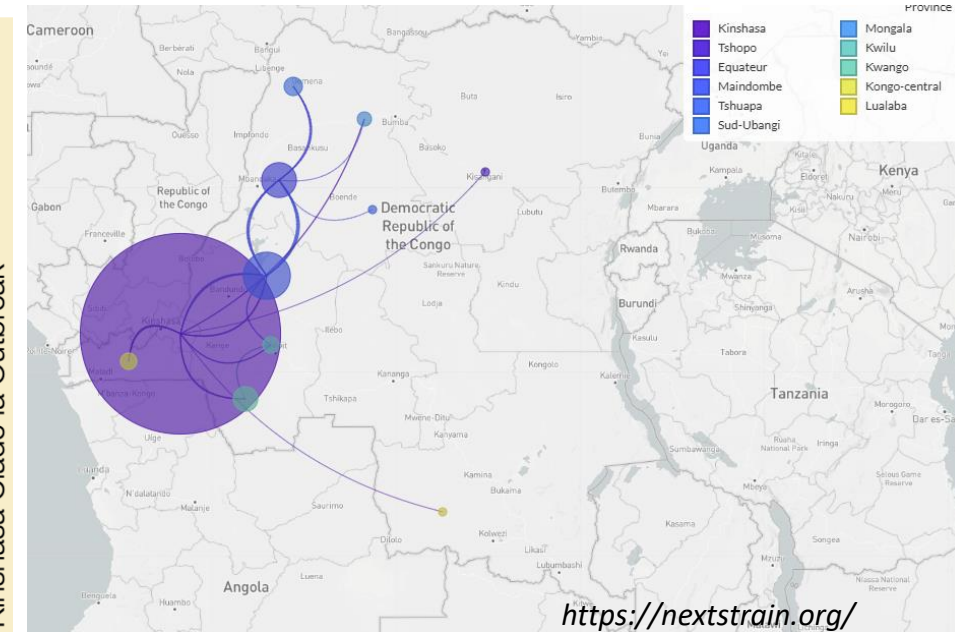
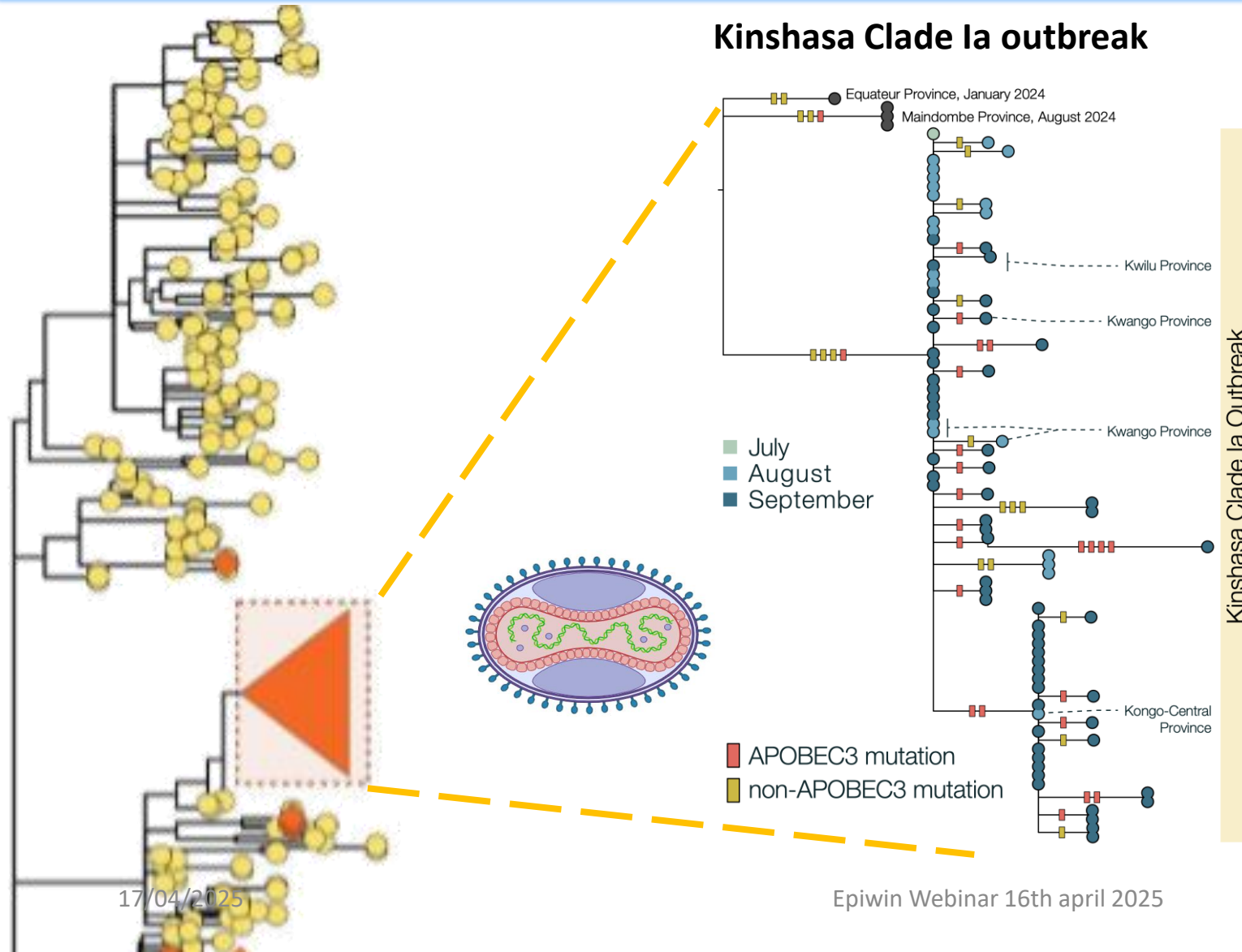


Expansion into other provinces
Tshopo, Tanganyika, Haut-Katanga, Kasai,
Kongo-Central, Maindombe and outside the
DRC...
With clade Ia/clade Ib cocirculation Sh-2023

**High rate of type APOBEC3
mutations**



Emergence of a major clade Ia variant in Kinshasa

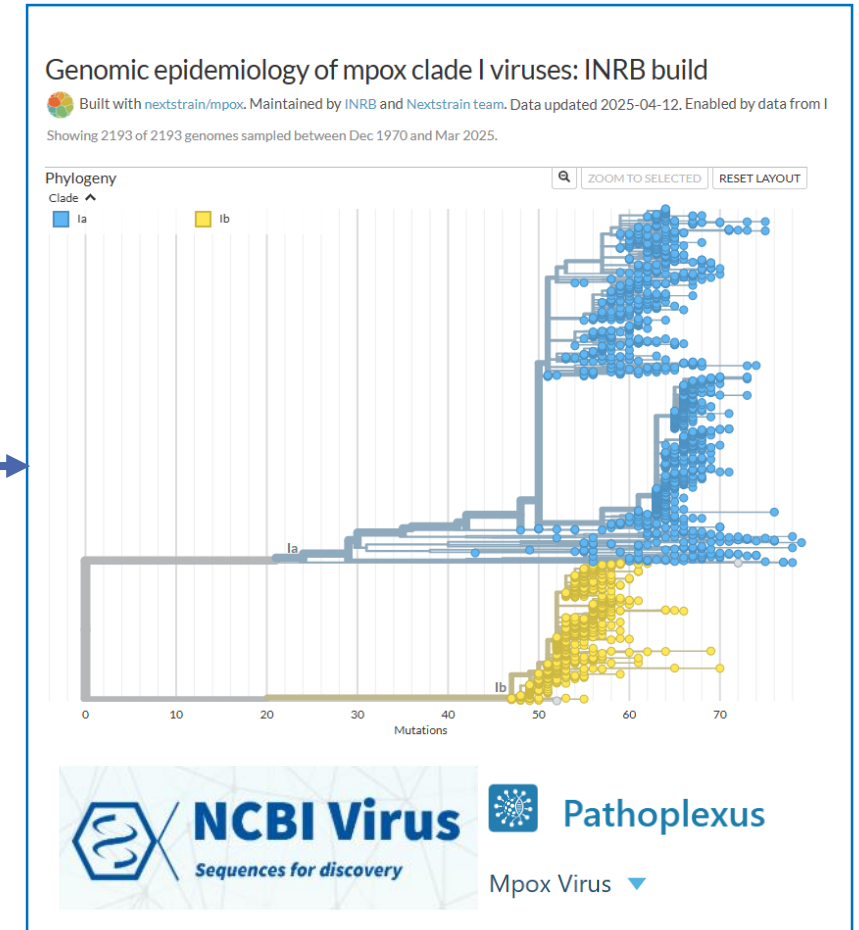
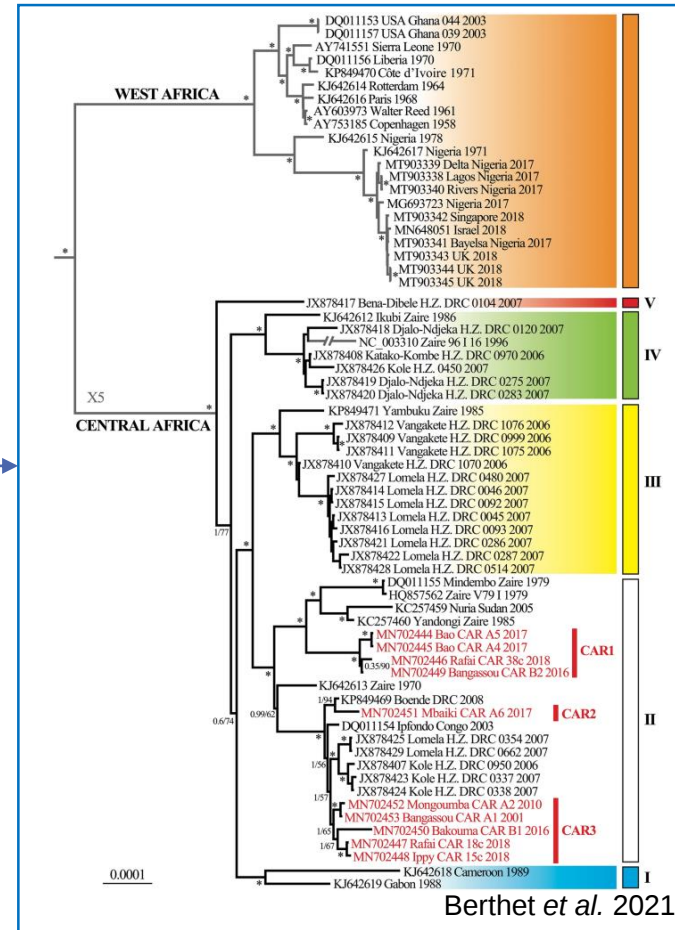
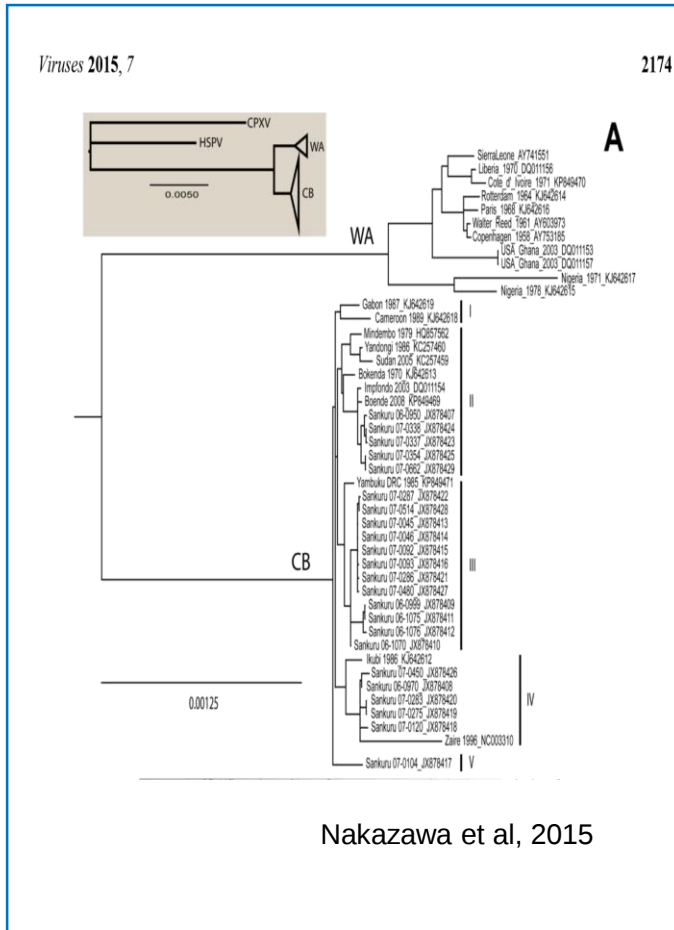


High rate of APOBEC3 transfers and expansion in the provinces and outside Outbreak at sh-2024a

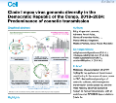
Updating the genetic diversity of mpox clade I

+10

>x20



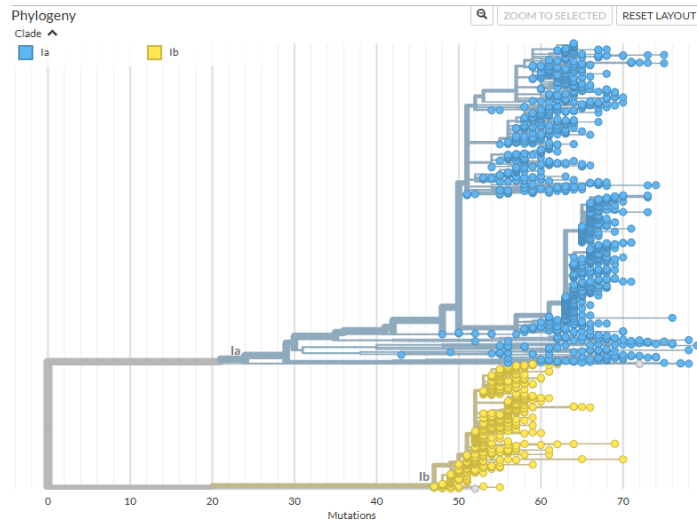
Both subclades detected in 7 provinces



Genomic epidemiology of mpox clade I viruses: INRB build

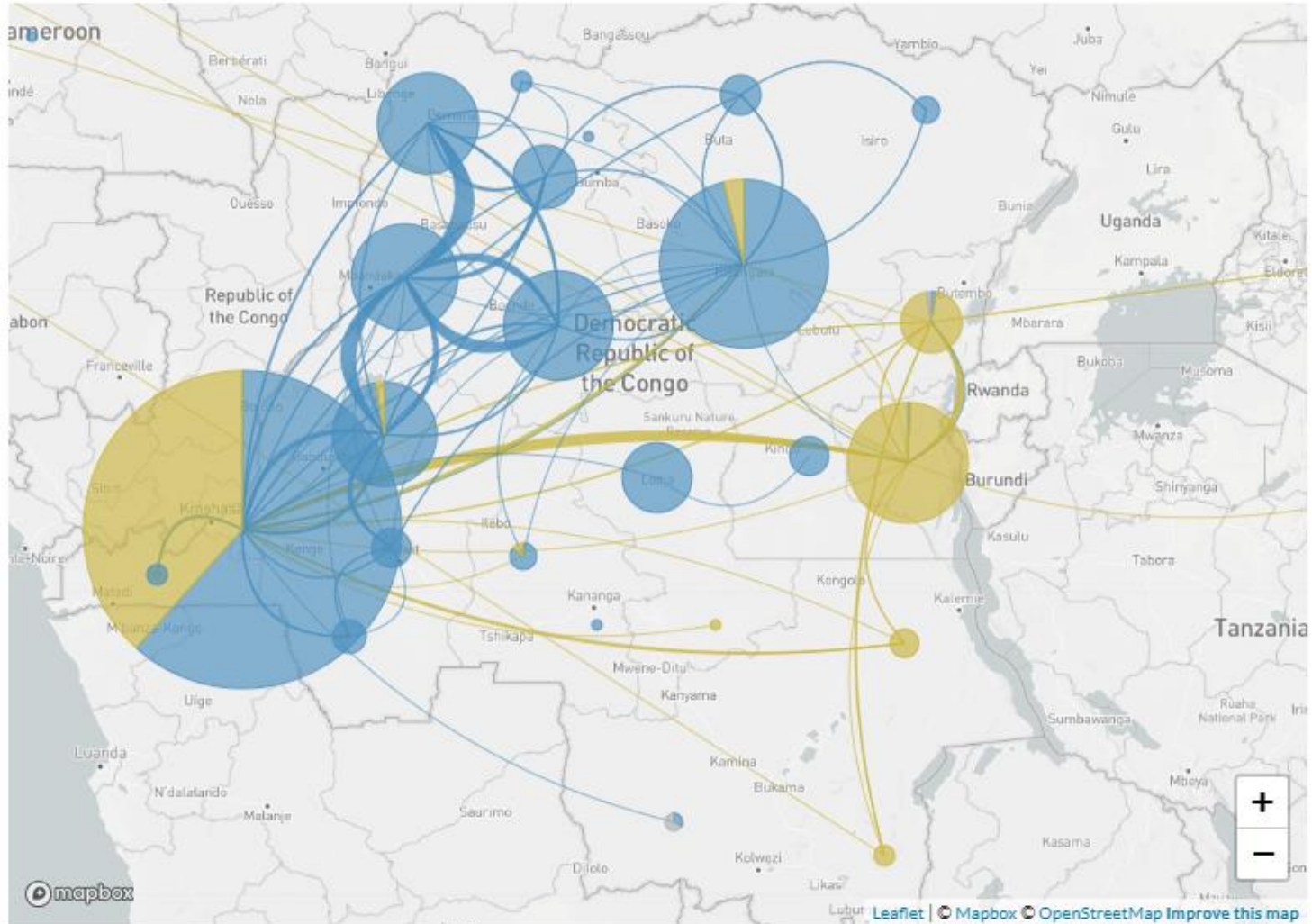
Built with nextstrain/mpox. Maintained by INRB and Nextstrain team. Data updated 2025-04-12. Enabled by data from I

Showing 2193 of 2193 genomes sampled between Dec 1970 and Mar 2025.

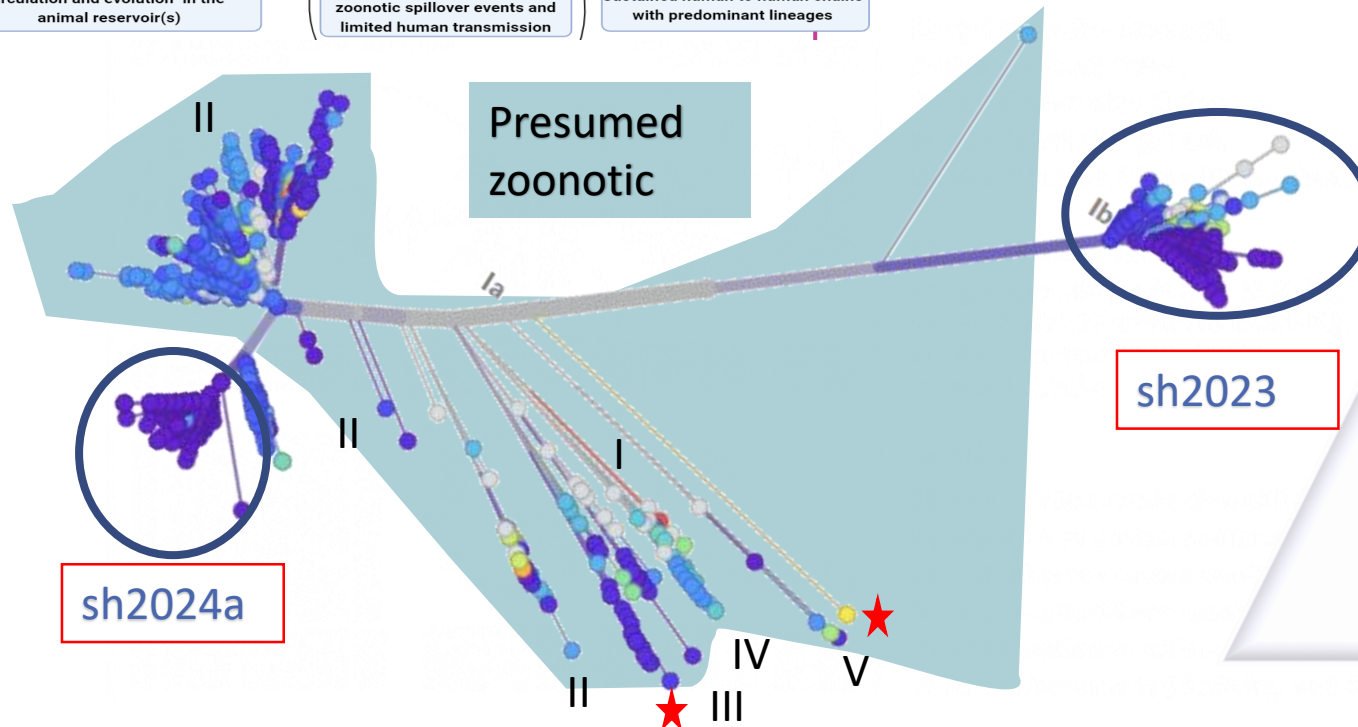
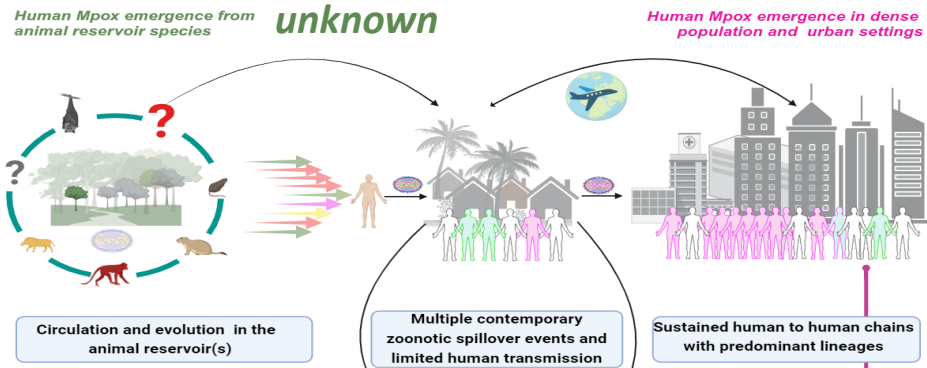


Pathoplexus

Mpox Virus ▼



In summary



Predominant zoonotic transmission
(in DRC)

Need to document the reservoir

Coexistence of risk factors for
emergence

Emergence of human-adapted
variants

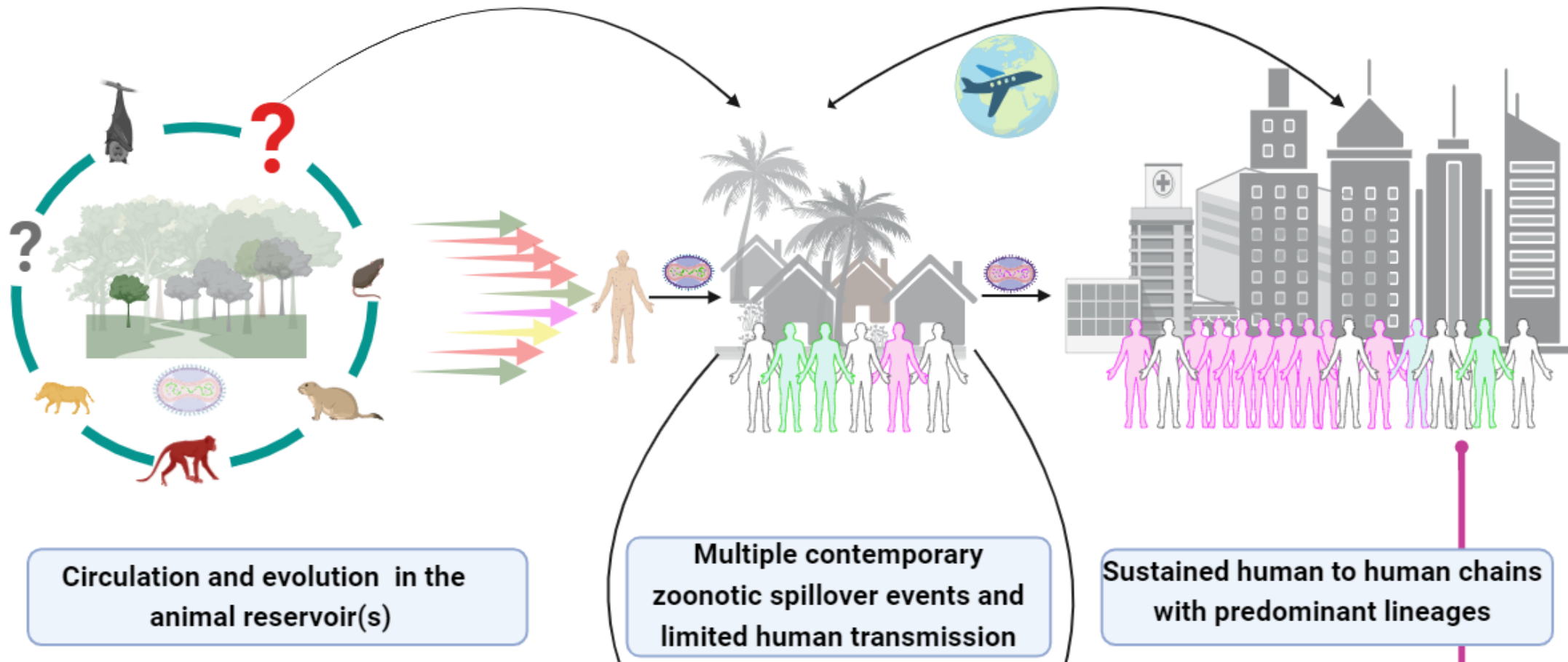
Continue to monitor key
populations

Development of diagnostic and
surveillance strategies

- PCR clade, Waste water surveillance

Human Mpox emergence from unknown animal reservoir species

Human Mpox emergence in dense population and urban settings



Genomic surveillance remains crucial to control emergences!



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Acknowledgments to all colleagues, MoH teams, and involved partners

