



Webinaire SOBEPIT Mpox 2024

24 Août 2024

Mpox:

Virologie & Diagnostic biologique

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Université de Lille, CHU de Lille

MONKEYPOX, VARIOLE DU SINGE, **MPOX**

Découverte, 1958



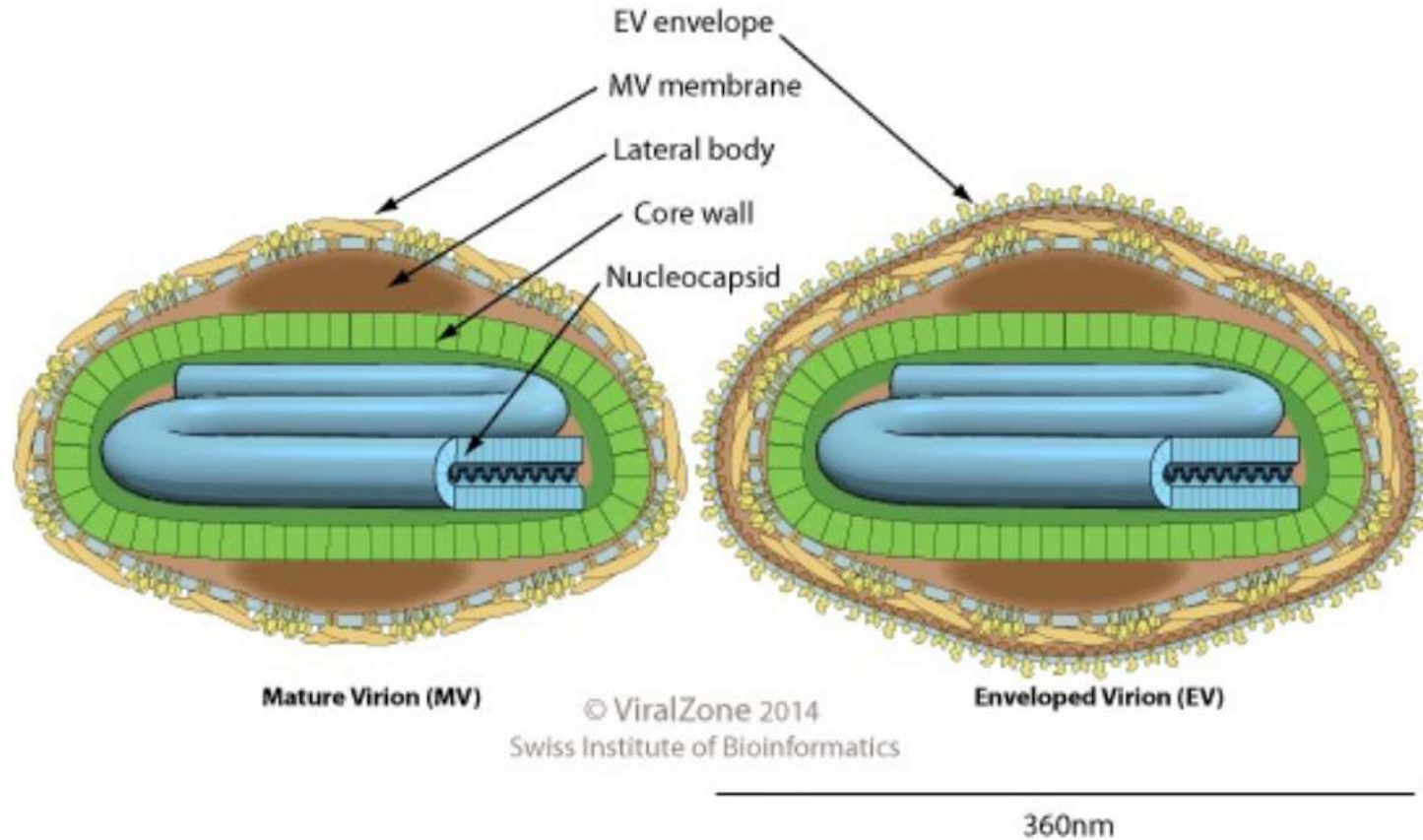
Macaca fascicularis

WHO recommends new name for monkeypox disease

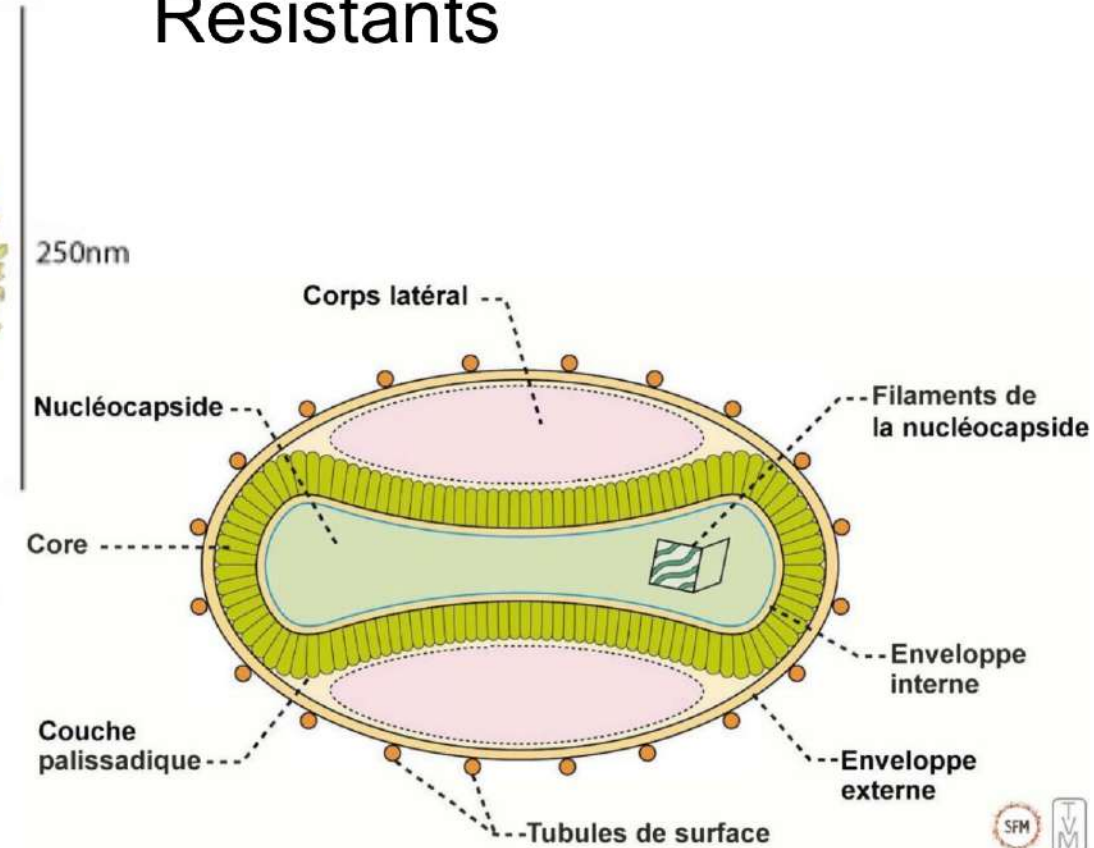
28 November 2022 | News release | Geneva, Switzerland | Reading time: 3 min (781 words)

Following a series of consultations with global experts, WHO will begin using a new preferred term “mpox” as a synonym for monkeypox. Both names will be used simultaneously for one year while “monkeypox” is phased out.

LA FAMILLE DES *POXVIRIDAE*



Virus à ADN
Gros virus enveloppés
Résistants



Oiseaux , ovins, caprins, lapins,
homme, primates, rongeurs.....

Et même des insectes 😊

PRINCIPAUX POXVIRUS INFECTANT LES HOMMES !

Genre	Virus
Orthopoxvirus	<i>Variola virus</i>
	<i>Vaccinia virus</i>
	<i>Cowpox virus</i>
	<i>Monkeypox virus</i>
Parapoxvirus	<i>Orf virus</i>
	<i>Pseudocowpox</i>
Molluscipoxvirus	<i>Molluscum contagiosum virus</i>
Yatapoxvirus	<i>Tanapox virus</i>

Réservoir humain

Réservoir animal

RÉSERVOIR...

- Le virus peut toucher une large gamme de mammifères..... Réservoir ???

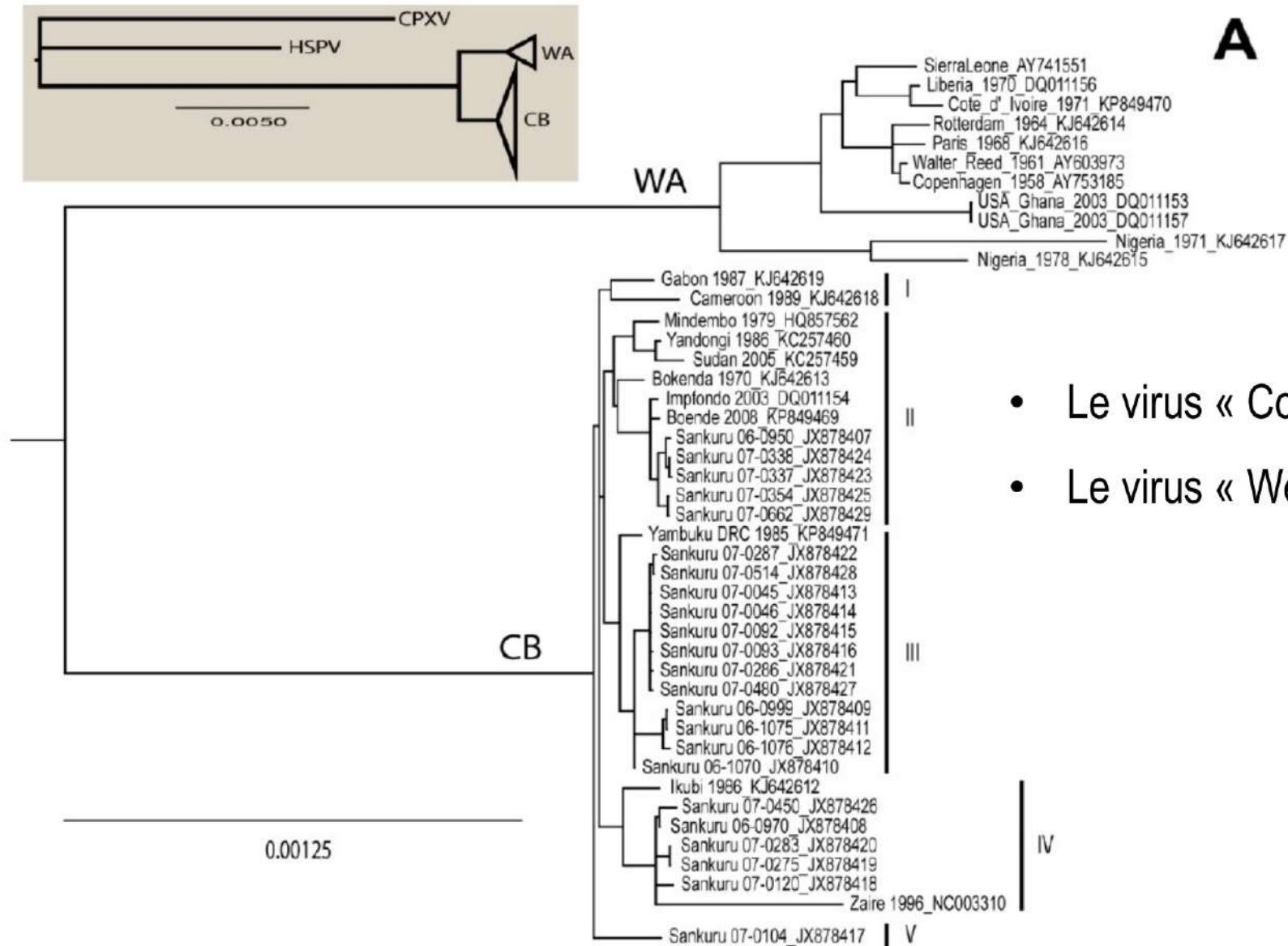
- Les rongeurs sont les suspects majeurs:

- Ecureuils
- Rats de Gambie
- Gerbilles
- Loirs africains



- Les primates et antilopes, infectés sporadiquement, peuvent jouer un rôle de réservoir secondaire et d'amplification

DEUX CLADES HISTORIQUES



- Le virus « Congo Basin »: CB
- Le virus « West Africa »: WA

DEUX CLADES HISTORIQUES

CB plus virulent que WA

> [J Gen Virol.](#) 2005 Oct;86(Pt 10):2661-2672. doi: 10.1099/vir.0.81215-0.

A tale of two clades: monkeypox viruses

Anna M Likos¹, Scott A Sammons¹, Victoria A Olson¹, A Michael Frace¹, Yu Li¹,
Melissa Olsen-Rasmussen¹, Whitney Davidson¹, Renee Galloway¹, Marina L Khristova¹,
Mary G Reynolds¹, Hui Zhao¹, Darin S Carroll¹, Aaron Curns¹, Pierre Formenty²,
Joseph J Esposito¹, Russell L Regnery¹, Inger K Damon¹

Comparative Study

> [J Gen Virol.](#) 2009 Sep;90(Pt 9):2266-71. doi: 10.1099/vir.0.010207-0.

Epub 2009 May 27.

Virulence and pathophysiology of the Congo Basin and West African strains of monkeypox virus in non-human primates

Masayuki Saijo¹, Yasushi Ami, Yuri Suzuki, Noriyo Nagata, Naoko Iwata, Hideki Hasegawa,
Itoe Iizuka, Tomoyuki Shiota, Kouji Sakai, Momoko Ogata, Shuetsu Fukushima, Tetsuya Mizutani,
Tetsutaro Sata, Takeshi Kurata, Ichiro Kurane, Shigeru Morikawa

> [Virology.](#) 2005 Sep 15;340(1):46-63. doi: 10.1016/j.virol.2005.05.030.

Virulence differences between monkeypox virus isolates from West Africa and the Congo basin

Nanhai Chen¹, Guiyun Li, M Kathryn Liszewski, John P Atkinson, Peter B Jahrling, Zehua Feng,
Jill Schriewer, Charles Buck, Chunlin Wang, Elliot J Lefkowitz, Joseph J Esposito, Tiara Harms,
Inger K Damon, Rachel L Roper, Chris Upton, R Mark L Buller

Review

> [Clin Microbiol Infect.](#) 2023 Dec;29(12):1502-1507. doi: 10.1016/j.cmi.2023.07.011.

Epub 2023 Jul 27.

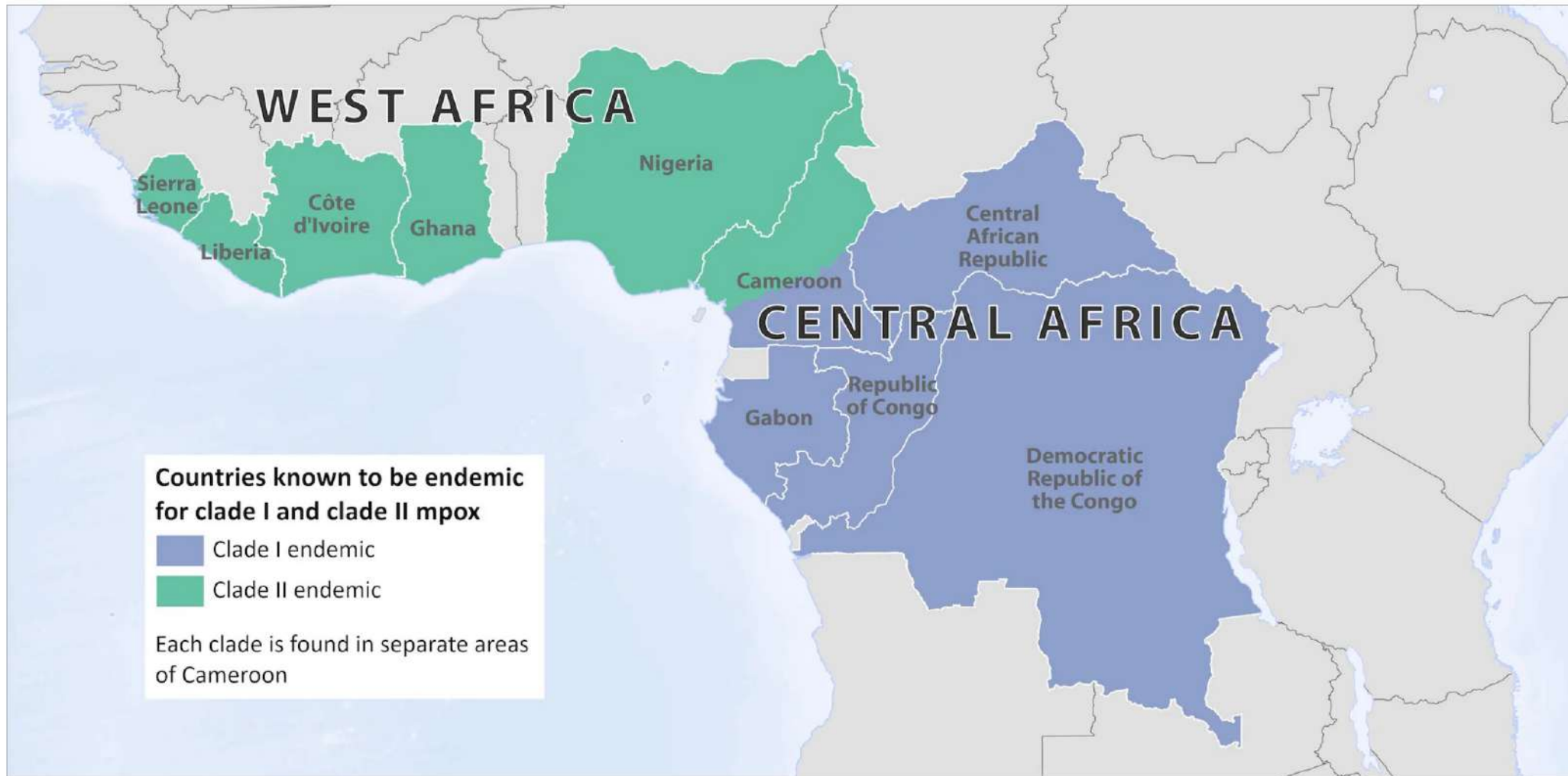
A contemporary review of clade-specific virological differences in monkeypox viruses

Tochi Okwor¹, Placide K Mbala², David H Evans³, Jason Kindrachuk⁴

NOUVEAUX CLADES

Monkeypox: experts give virus variants new names

12 August 2022 | News release | Geneva | Reading time: 2 min (501 words)



NOUVEAUX CLADES



DATE OF ISSUE: 30 JULY 2024

Mpox Situation in Africa

www.africacdc.org

    [africacdc](#)



Clade I

Burundi, CAR, Congo,
DRC, Rwanda



Clade II

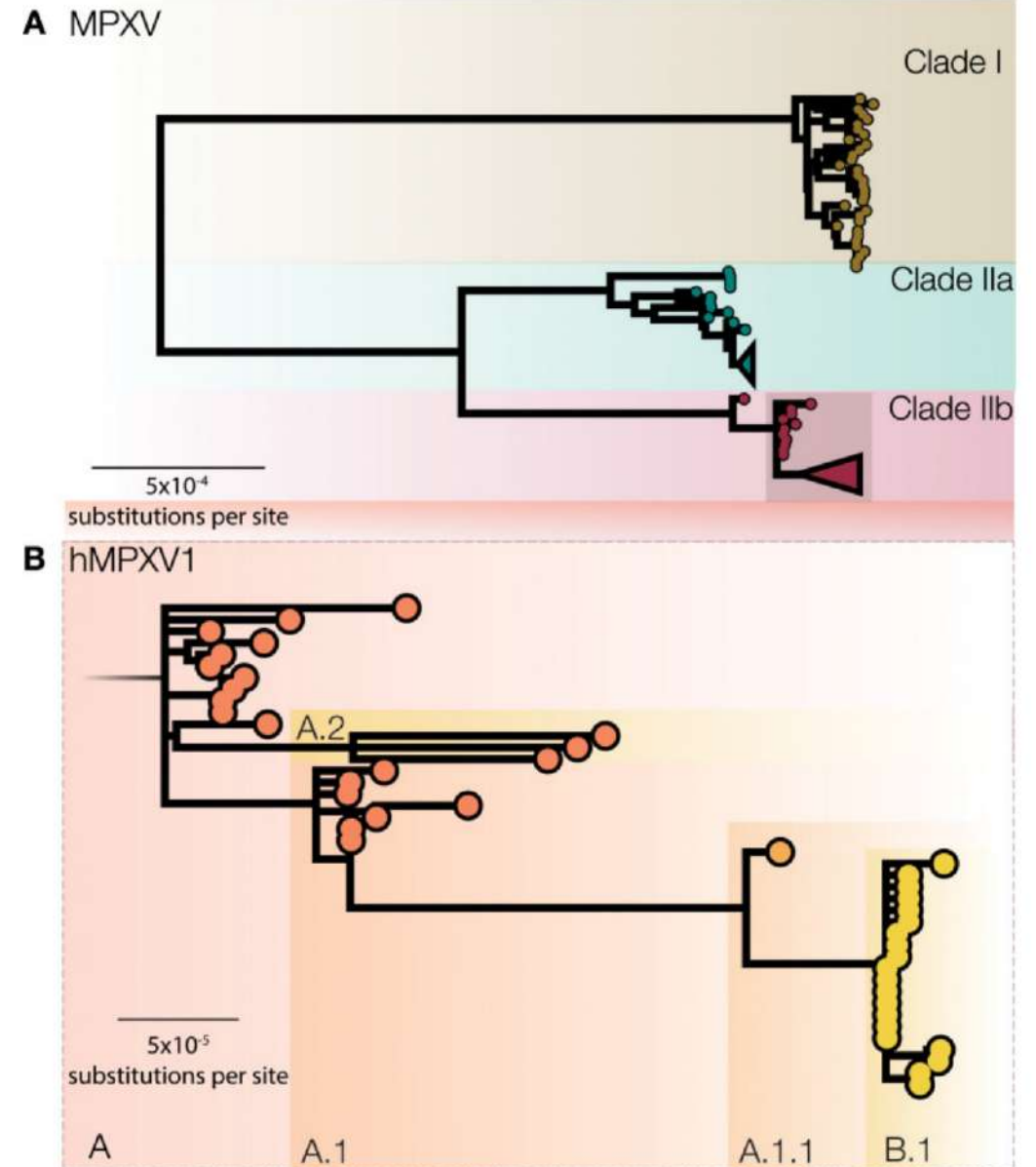
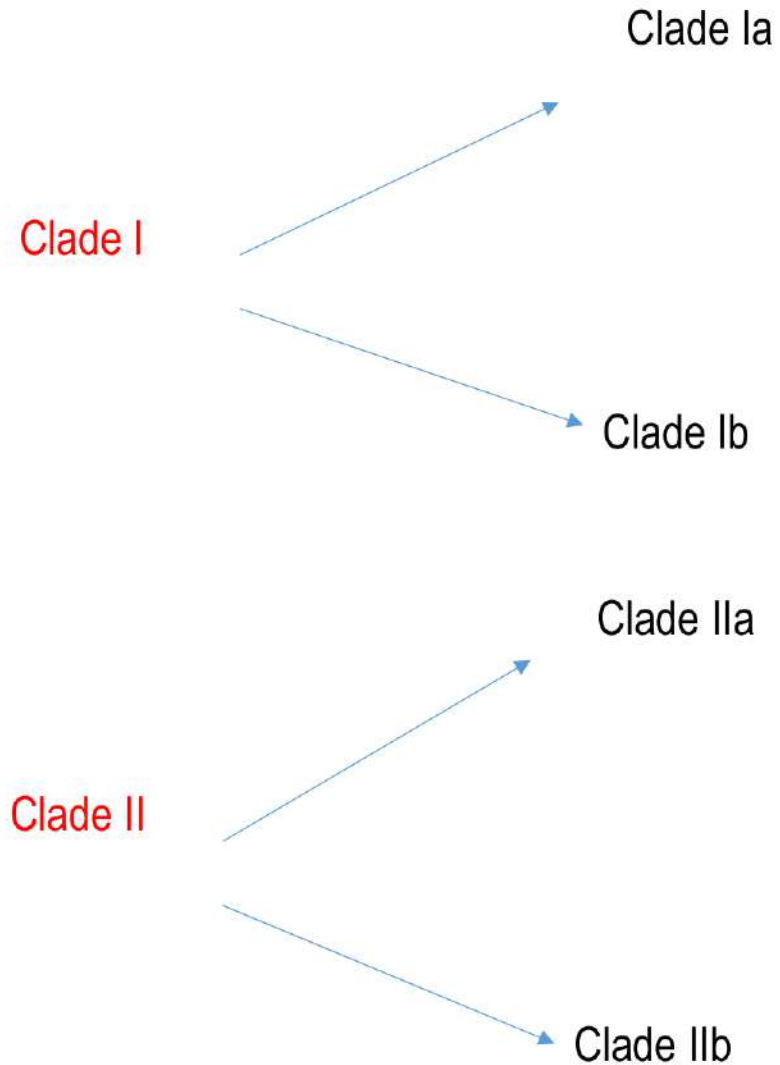
Benin, Egypt, Ghana, Liberia,
Mozambique, Morocco,
Nigeria, Sudan, South Africa



Clade I & II

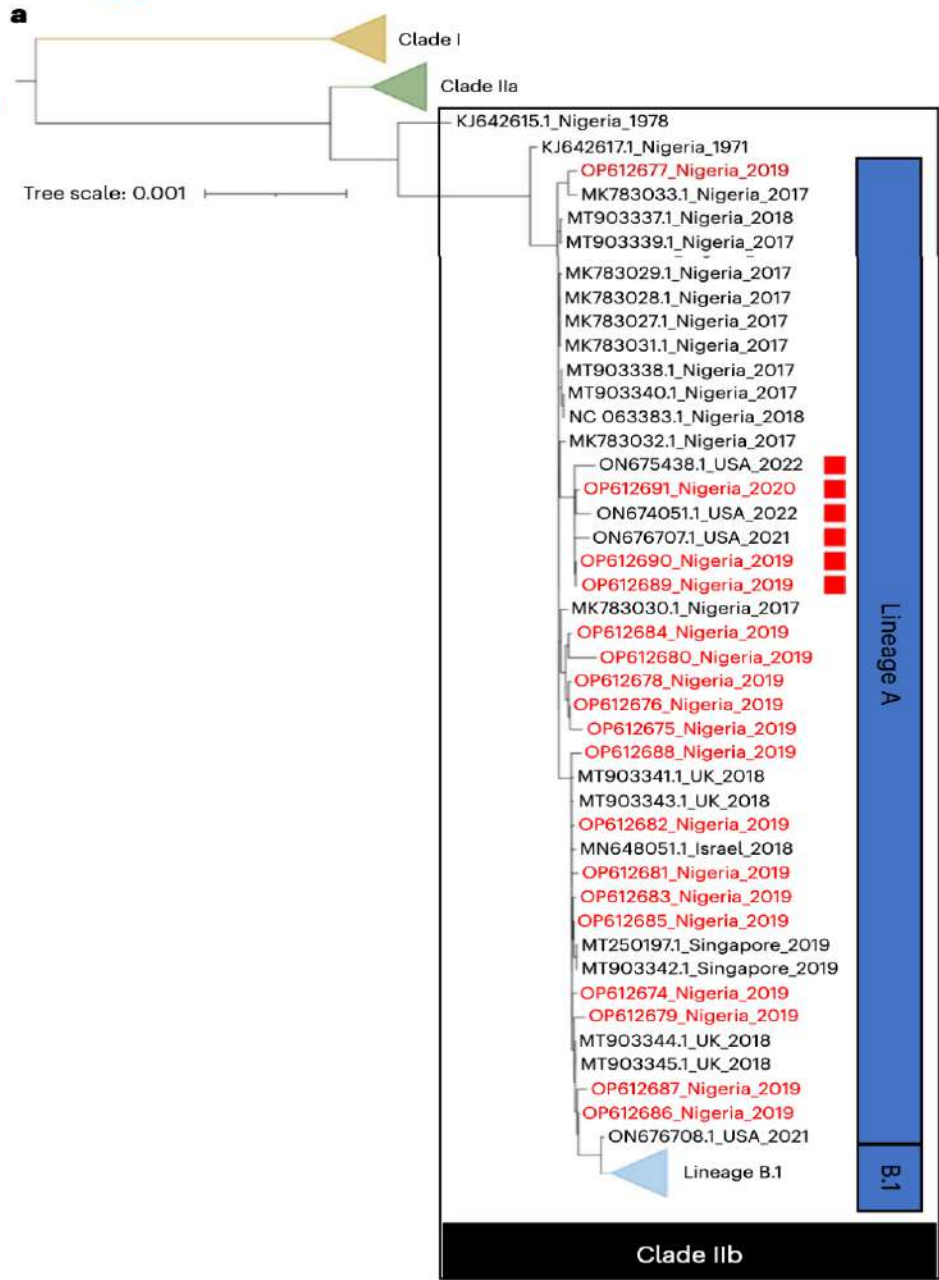
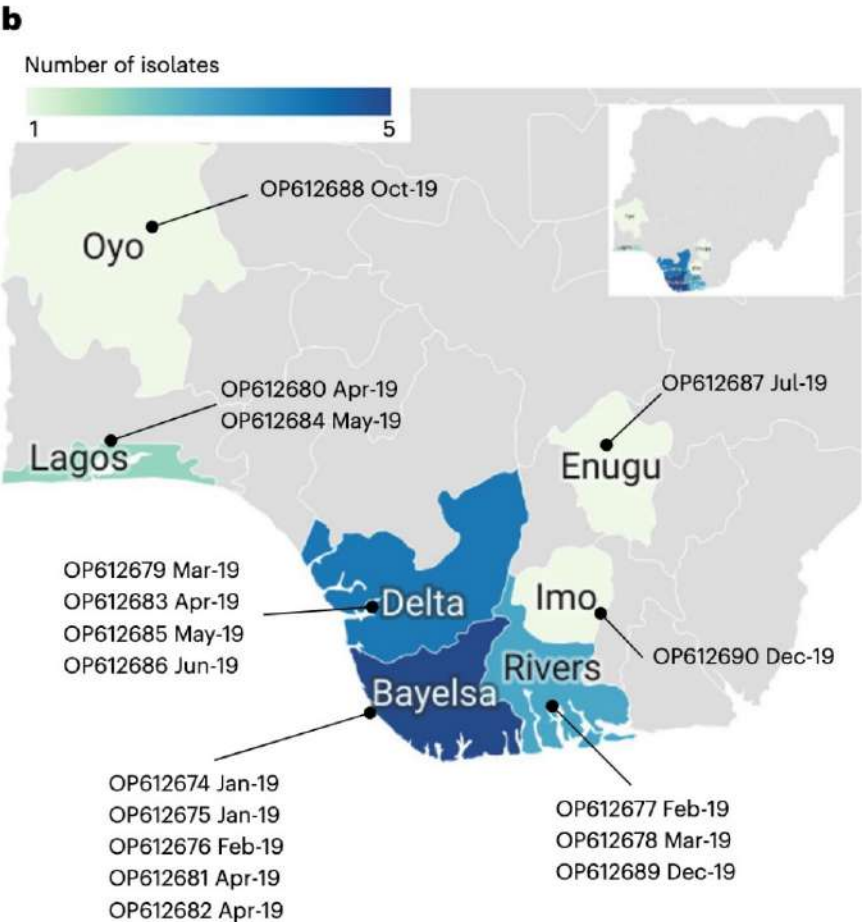
Cameroon

NOUVEAUX CLADES



Distinct monkeypox virus lineages co-circulating in humans before 2022

 Ndodo N, Nature Medicine , Sept 2023

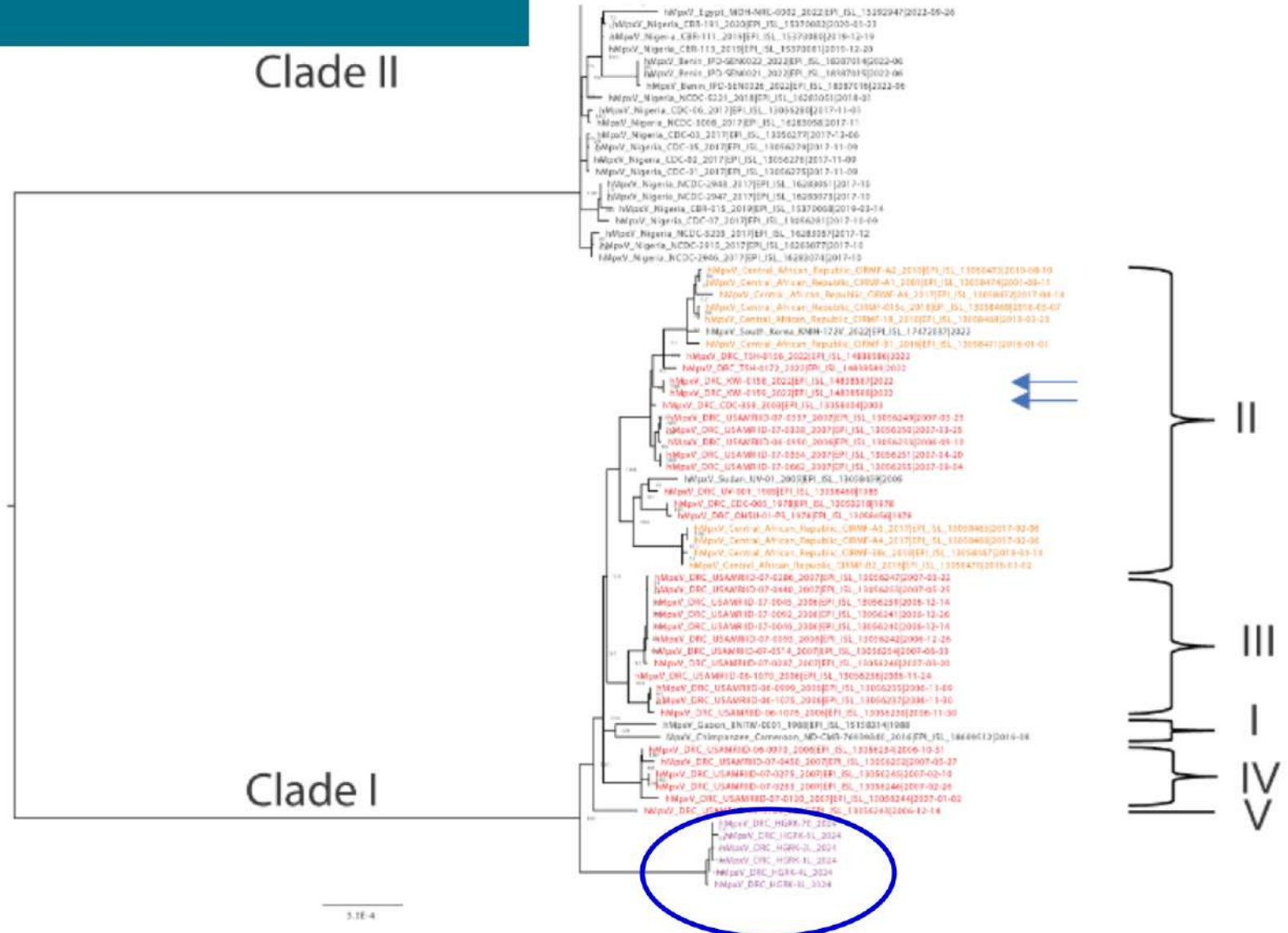


Ongoing mpox outbreak in Kamituga, South Kivu province, associated with monkeypox virus of a novel Clade I sub-lineage, Democratic Republic of the Congo, 2024

Masiriki LM, Eurosurveillance 2024

Clade II

Clade I



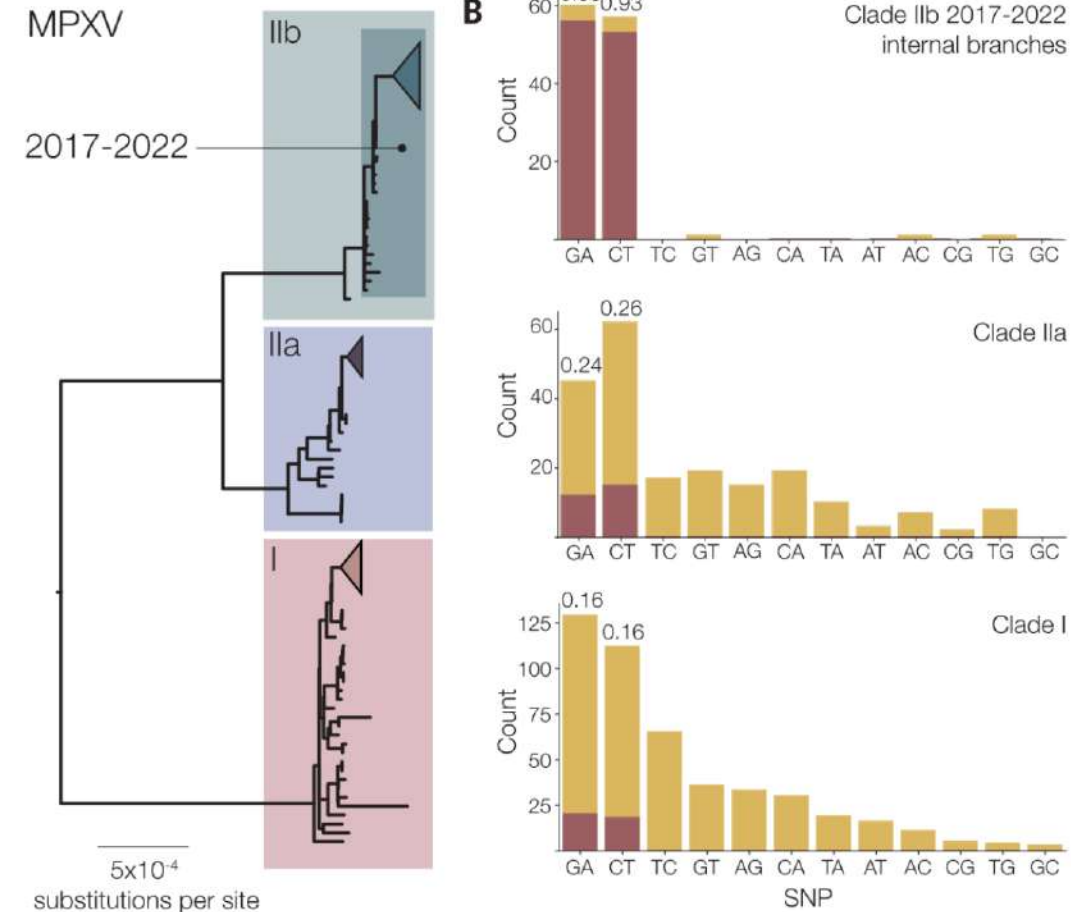
CLADES IIb, Ib ET TRANSMISSION INTERHUMAINE

MPOX

APOBEC3 deaminase editing in mpox virus as evidence for sustained human transmission since at least 2016

Áine O'Toole^{1*}, Richard A. Neher², Nnaemeka Ndodo³, Vitor Borges⁴, Ben Gannon⁵, João Paulo Gomes^{4,6}, Natalie Groves⁷, David J. King⁸, Daniel Maloney¹, Philippe Lemey⁹, Kuiama Lewandowski⁵, Nicholas Loman^{7,10}, Richard Myers⁷, Ifeanyi F. Omah^{1,11}, Marc A. Suchard¹², Michael Worobey¹³, Meera Chand^{7,14}, Chikwe Ihekweazu³, David Ulaeto^{7†}, Ifedayo Adetifa^{3†}, Andrew Rambaut^{1*†}

Science **382**, 595–600 (2023) 3 November 2023



CLADES IIB, IB ET TRANSMISSION INTERHUMAINE

nature medicine

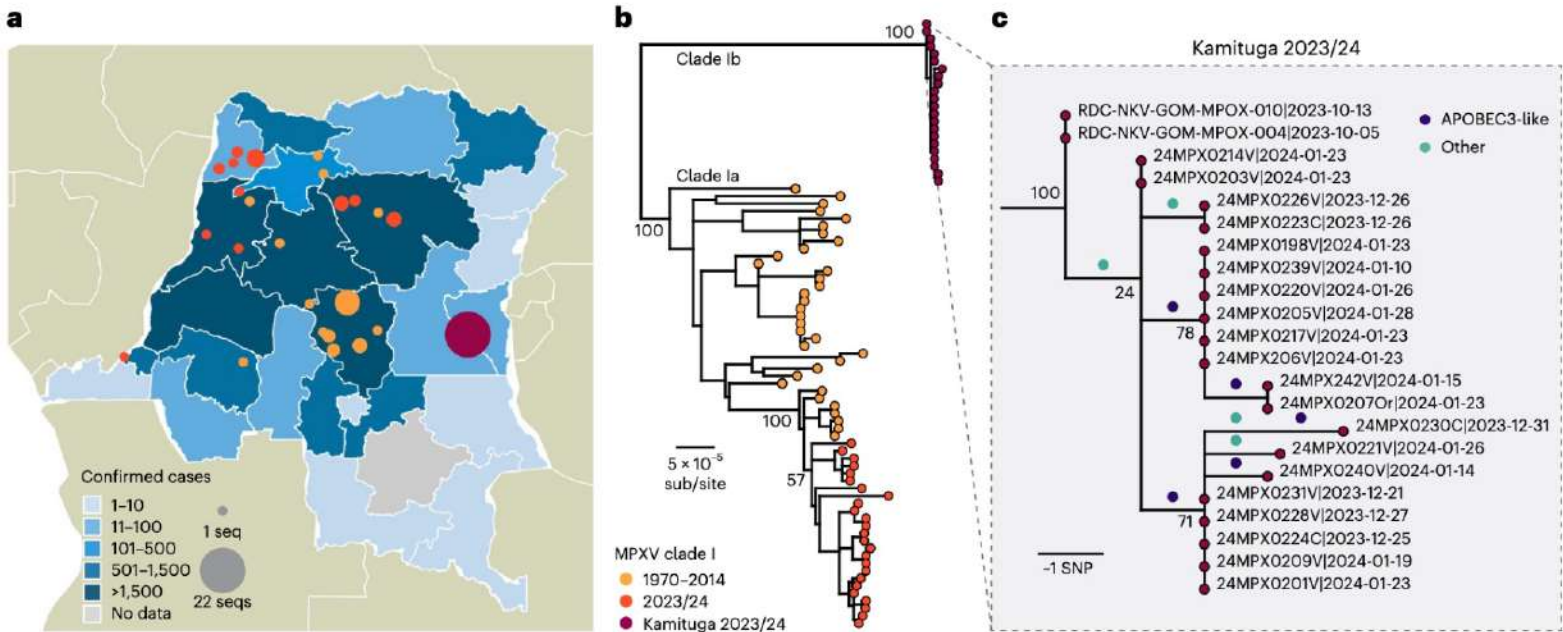


Vakaniaki EH, Nature Medicine , June 2024

Brief Communication

<https://doi.org/10.1038/s41591-024-03130-3>

Sustained human outbreak of a new MPXV clade I lineage in eastern Democratic Republic of the Congo



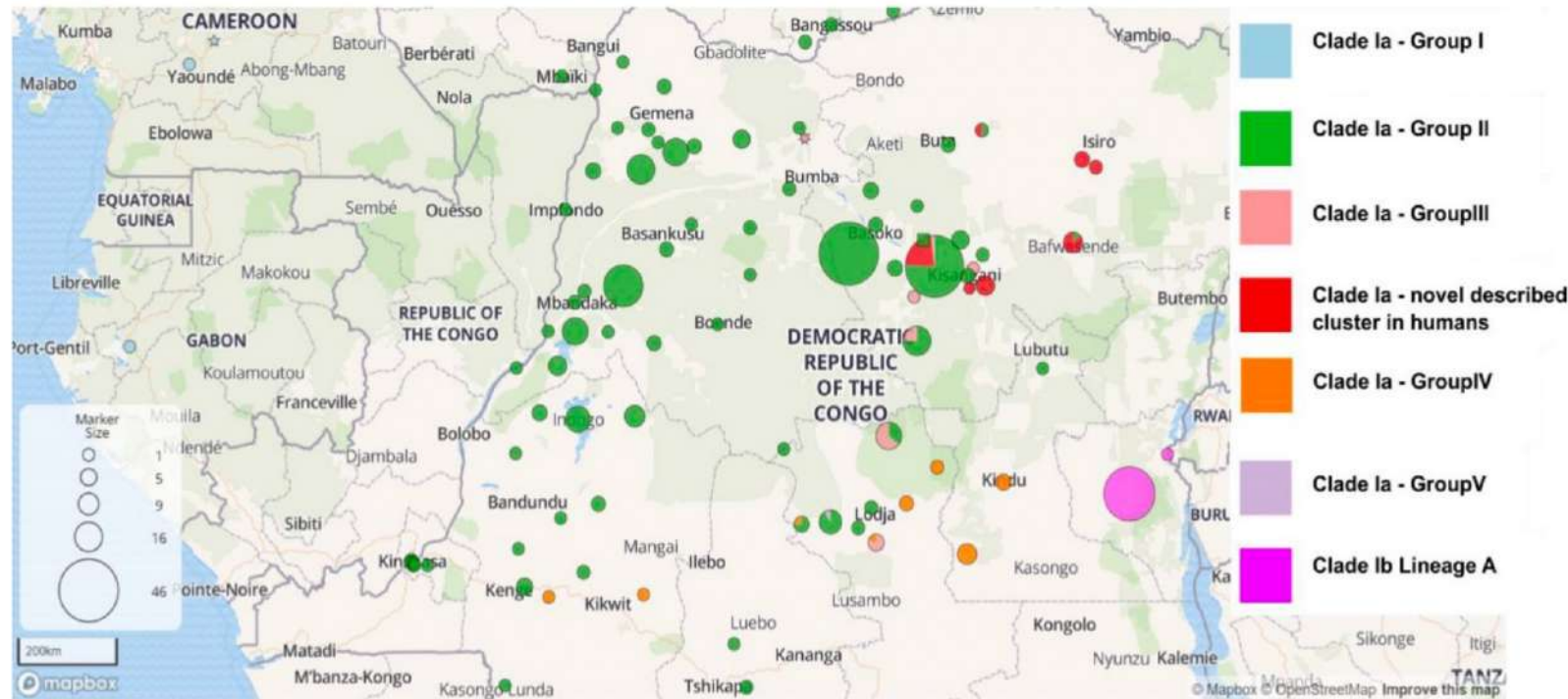
Transmission interhumaine +++

Rôle important de l'exposition sexuelle

Clade I Mpox virus genomic diversity in the Democratic Republic of the Congo, 2018 - 2024: Predominance of Zoonotic Transmission

^{ID} Eddy Kinganda-Lusamaki, ^{ID} Adrienne Amuri-Aziza, ^{ID} Nicolas Fernandez, ^{ID} Jean-Claude Makangara-Cigolo, ^{ID} Catherine Pratt, ^{ID} Emmanuel Hasivirwe Vakaniaki, ^{ID} Nicole A. Hoff, Gradi Luakanda, Prince Akil-Bandali, ^{ID} Sabin Sabiti Nundu, Noella Mulopo-Mukanya, Michel Ngimba, Brigitte Modadra-Madakpa, Ruth Diavita, Princesse Paku, Elisabeth Pukuta-Simbu, ^{ID} Sydney Merritt, Áine O'Toole, ^{ID} Nicola Low, Antoine Nkuba, ^{ID} Hugo Kavunga, Robert Shongo, ^{ID} Laurens Liesenborghs, ^{ID} Tony Wawina-Bokalanga, ^{ID} Koen Vercauteren, ^{ID} Daniel Mukadi-Bamuleka, ^{ID} Lorenzo Subissi, ^{ID} Jean-Jacques Muyembe, ^{ID} Jason Kindrachuk, Ahidjo Ayoub, Andrew Rambaut, ^{ID} Eric Delaporte, ^{ID} Sofonias Tessema, ^{ID} Anne W. Rimoin, ^{ID} Lisa E. Hensley, ^{ID} Placide Mbala-Kingebeni, ^{ID} Martine Peeters, Steve Ahuka-Mundeke

doi: <https://doi.org/10.1101/2024.08.13.24311951>



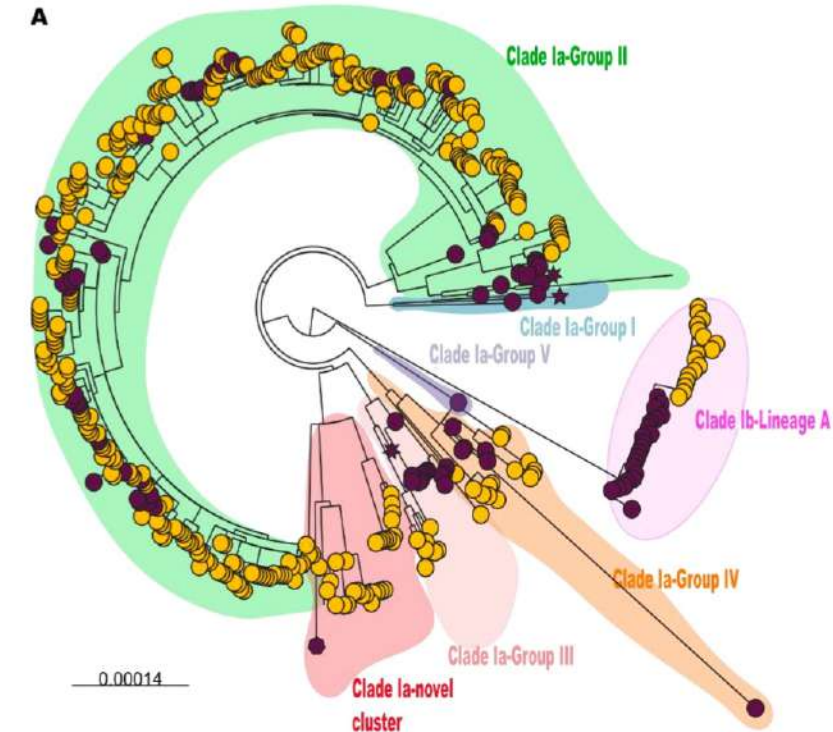
medRxiv

THE PREPRINT SERVER FOR HEALTH SCIENCES

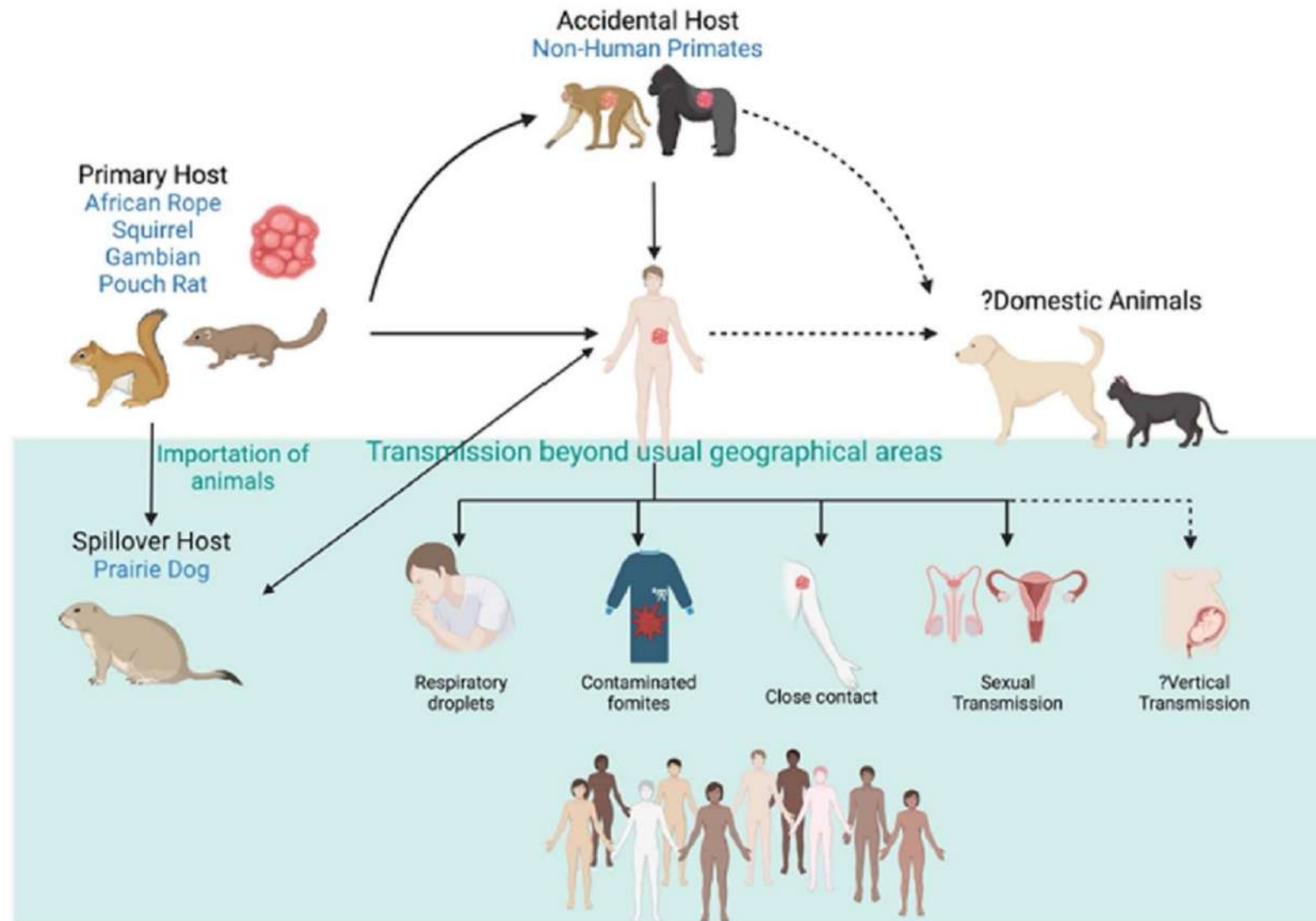


Cold Spring Harbor Laboratory

BMJ Yale



MPXV: UN MOT DE PHYSIOPATHOLOGIE



MPXV: UN MOT DE PHYSIOPATHOLOGIE

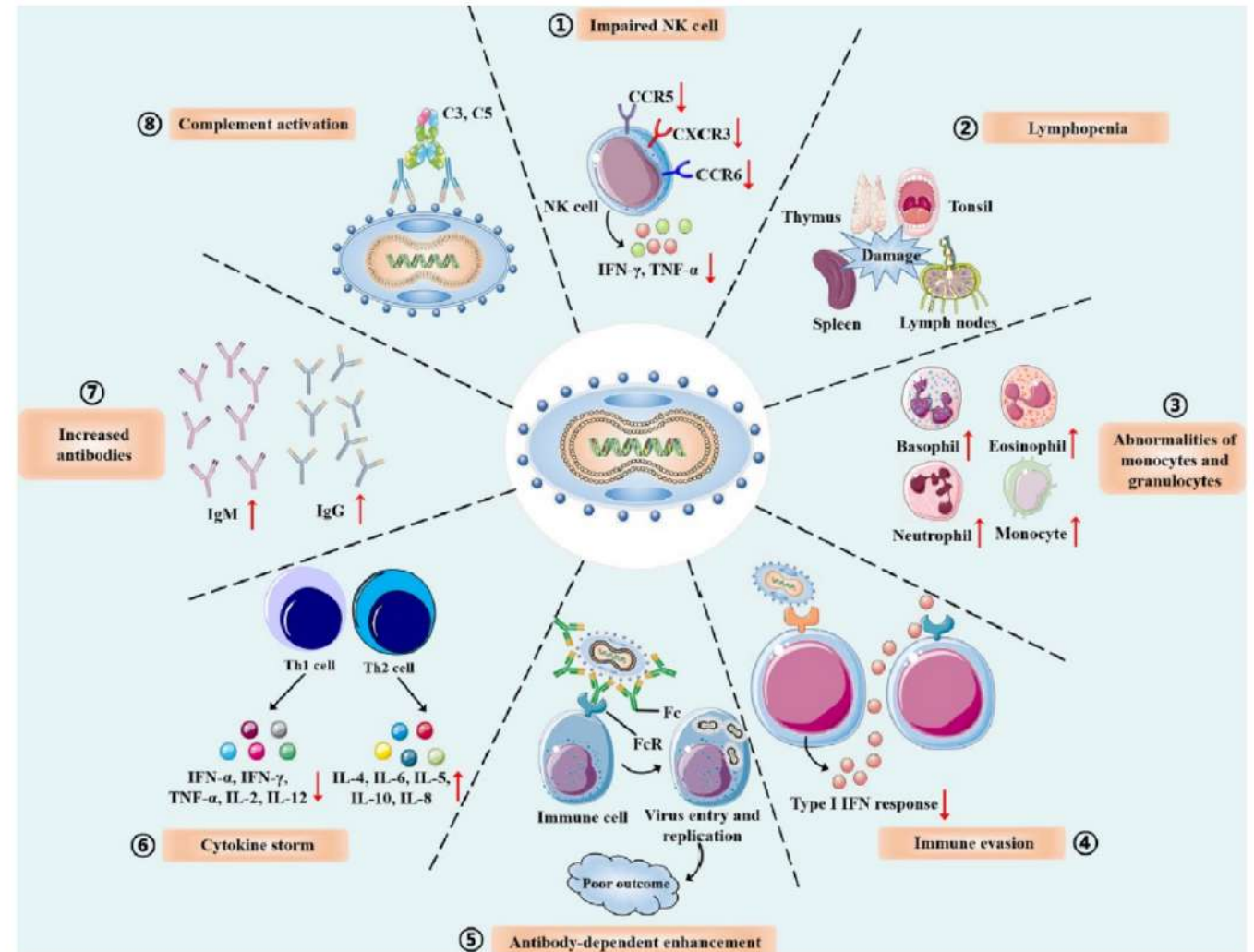
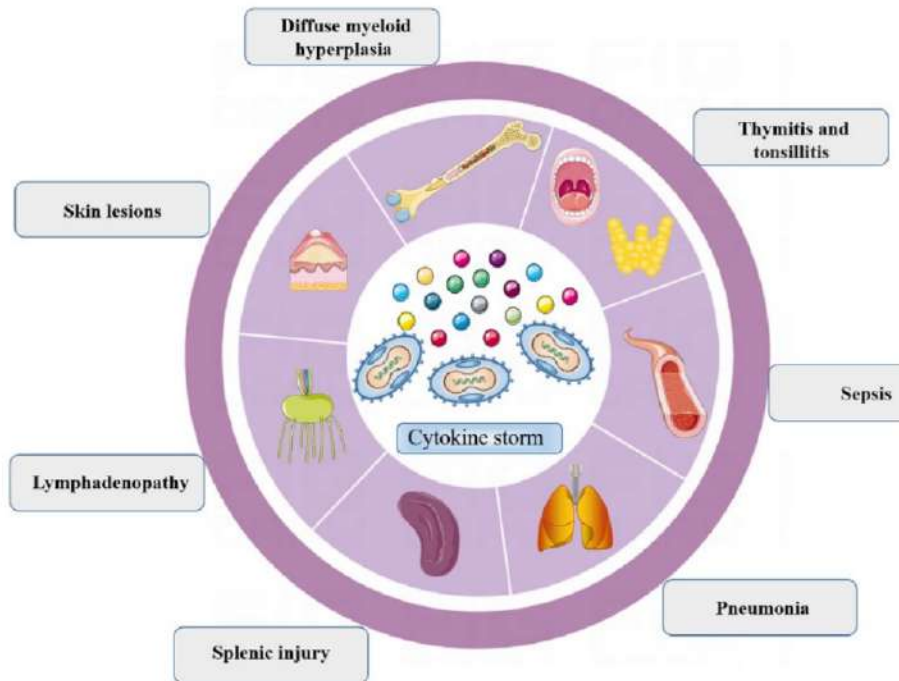
Quel que soit le mode de transmission....

- Multiplication du virus au niveau du site d'inoculation
- Dissémination aux ganglions locaux
- Virémie et dissémination hématogène à tous les organes ; la virémie corrèle avec l'apparition des premiers prodromes

The land-scape of immune response to monkeypox virus

eBioMedicine
2023;87: 104424

Heng Li,^{a,h} Qi-Zhao Huang,^{b,h} Hong Zhang,^{c,h} Zhen-Xing Liu,^a Xiao-Hui Chen,^a Li-Lin Ye,^{d,**} and Yang Luo^{e,f,g,*}



The background of the slide is a solid dark blue color. It is decorated with a repeating pattern of white, complex geometric shapes. These shapes are composed of multiple overlapping polygons, creating a faceted, crystalline appearance. They are arranged in a grid-like fashion, with some shapes slightly offset from others, giving a sense of depth and movement.

Diagnostic biologique

MPXV: DIAGNOSTIC DIRECT

PCR : méthode de choix

→ sur lésion cutanéomuqueuse : frottis ou biopsie, croûte (dans milieu de transport viral (VTM))

→ Frottis de gorge (dans VTM) (avant apparition des lésions cutanéomuqueuses)

→ Autres: plasma sang EDTA (virémie courte), urines...

Virus Classe 3: Mesures de biosécurité

Prélèvements pour la PCR...

Génital

Douleurs, parfois signe d'urétrite (écoulement, brûlures mictionnelles)



Anal

Signes de rectite : écoulement, douleurs, épreinte, ténesme, faux-besoin



Prélèvements pour la PCR...

Oropharyngé

Odynophagie, angine ulcéro-nécrotique, érosions buccales



Cutané

Lésions cutanées primaires : pubis, visage, mamelon...

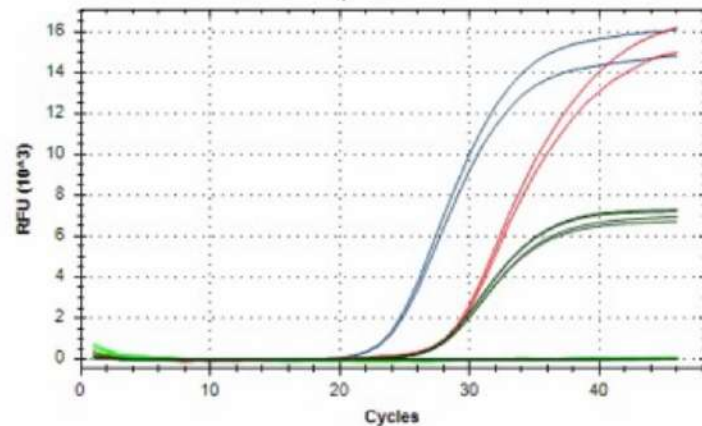


MPXV: DIAGNOSTIC DIRECT

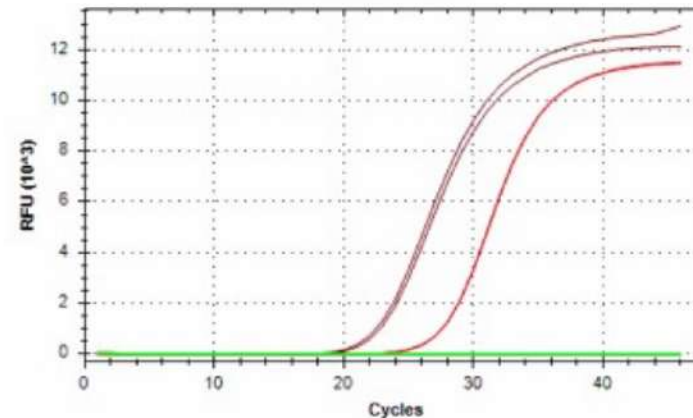
PCR : méthode de choix

→ PCR de genre Orthopoxvirus

→ PCR spécifique Monkeypox virus



PCR OPV 14Kd



PCR MPXV G2R G

MPXV: DIAGNOSTIC DIRECT

Journal of Virological Methods 169 (2010) 223–227



Contents lists available at ScienceDirect
Journal of Virological Methods
journal homepage: www.elsevier.com/locate/jviromet



Short communication

Real-time PCR assays for the specific detection of monkeypox virus West African and Congo Basin strain DNA

Yu Li*, Hui Zhao, Kimberly Wilkins, Christine Hughes, Inger K. Damon

Poxvirus and Rabies Branch, Division of High-Consequence Pathogens and Pathology (Proposed), National Center for Emerging and Zoonotic Infectious Diseases (Proposed), Centers for Disease Control and Prevention, Atlanta, GA, United States

(A) Monkeypox virus West Africa Specific (G2R_WA) assay design

	Forward primer	Probe	Reverse primer
MPXV_USA03	CCGTGTGTGTCCTGGGACATATTTCTCACACCGTCTCTTCCACAGATAAATGCGAACCCGTCGTAACGACCAATACATTTAACTATATCGATGTGTGAATTAACCTGTATCCAGTCAACGACACATCGTGTACTCGGACG		
MPXV_SLE			
MPXV_ZAR79			
MPXV_RCG03			
VARV_BGD75	TT		CA
VARV_CHN48	TT		CA
VARV_BRA66	TT		CA
CHLV_CMS			
VACV_WR			
VACV_Acam2	T		T
CPXV_GRI	C		T
CPXV_GER91	T		C

(B) Monkeypox virus Congo Basin (C3L) assay design

	Forward primer	Probe	Reverse primer
MPXV_ZAR79	CTATAGAATATCTATGTCTACCTGGATACAGAAAGCAAAATATGGGACCCATATATGCTAAATGTACCGGTACCGGATGGACACTCTTTAATCAATGTATTAAACGGAGATGCCATCGCTCGAGATATCGATA		
MPXV_RCG03			
VACV_COP			
VACV_WR			
VARV_BGD75			
VARV_CHN48			
VARV_BRA66			
CHLV_CMS			
CPXV_GER91			
CPXV_GRI			
ECTV_MOS			

(C) Monkeypox virus generic (G2R_G) assay design

	Forward primer	Probe	Reverse primer
MPXV_USA03	GCACCAATGCAACATCCAAATGGAAGTGTAAAGACAAAGCAATACAGAAAGCC	GTAATCTATGTTGCTATCGTGTCTCCGGGAACCTTACGCTTCCAGATTATGTATAGCAAGACTAATACCAATGTACACC	
MPXV_SLE			
MPXV_ZAR79			
MPXV_RCG03			
VARV_BGD75	GT		A
VARV_CHN48	GT		A
VARV_BRA66	GT		A
CHLV_CMS			
VACV_WR			
VACV_DUK			
CPXV_GRI	AT		TT
CPXV_GER91	AT		TT

Ongoing mpox outbreak in Kamituga, South Kivu province, associated with monkeypox virus of a novel Clade I sub-lineage, Democratic Republic of the Congo, 2024

Leandre Murhula Masirika^{1,2}, Jean Claude Udahemuka^{3,4}, Leonard Schuele⁵, Pacifique Ndishimye^{4,6,7}, Saria Otani⁸, Justin Bengheya Mbiribindi⁹, Jean M. Marekani¹⁰, Léandre Mutimbwa Mambo¹¹, Nadine Malyamungu Bubala⁹, Marjan Boter⁵, David F. Nieuwenhuijse⁵, Trudie Lang¹², Ernest Balyahamwabo Kalalizi², Jean Pierre Musabyimana^{4,13}, Frank M. Aarestrup⁸, Marion Koopmans⁵, Bas B. Oude Munnink^{5,*}, Freddy Belesi Siangoli^{14,*}

A. Single nt mismatch with CDC-recommended generic reverse primer

GCTATCACATAATCTGGAAGCGTA		G2R_G_Reverse_Primer	
194834	A.....	194857	mpox_2L
194834	A.....	194857	mpox_9L
194834	A.....	194857	mpox_1L
194834	A.....	194857	mpox_3L
194834	A.....	194857	mpox_70
194834	A.....	194857	mpox_4L

ATCAATGTATTAAACGGAGATGCC		C3L_Reverse_Primer	
19706	-----	19729	mpox_2L
19706	-----	19729	mpox_9L
19706	-----	19729	mpox_1L
19706	-----	19729	mpox_3L
19706	-----	19729	mpox_70
19706	-----	19729	mpox_4L

B. Absence of target sequence for CDC-recommended Clade-I-specific real-time PCR

TTGCTTTCTGTATCCAGGTAGACA		C3L_Forward_Primer	
19782	-----	19805	mpox_2L
19782	-----	19805	mpox_9L
19782	-----	19805	mpox_1L
19782	-----	19805	mpox_3L
19782	-----	19805	mpox_70
19782	-----	19805	mpox_4L

TCCGGTACCGGTACATTTAGCATATATGGG		C3L_Probe	
19743	-----	19772	mpox_2L
19743	-----	19772	mpox_9L
19743	-----	19772	mpox_1L
19743	-----	19772	mpox_3L
19743	-----	19772	mpox_70
19743	-----	19772	mpox_4L

MPXV: DIAGNOSTIC INDIRECT

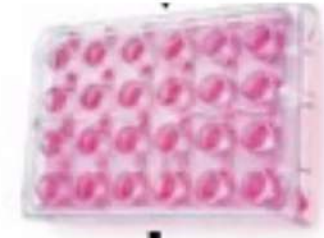
Sérologie: intérêt limité pour le diagnostic,
Non réalisé en routine, diagnostic rétrospectif ?

→ ELISA: recherche IgM/IgG

Apparition d'anticorps entre 5-8 jours après l'éruption cutanée

Immunité croisée entre Orthopoxvirus

→ Réaction de séroneutralisation



Merci pour votre attention
