RIESGOS SANITARIOS ASOCIADOS A LOS QUIRÓPTEROS

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[INSTITUTO DE INVESTIGACIÓN EN RECURSOS CINEGÉTICOS]

Patógenos Zoonóticos en Murciélagos

Gran diversidad de patógenos en murciélagos; Creciente investigación en nuevos virus desconocidos.

Importante papel como reservorio silvestre de patógenos ZOONÓTICOS de GRAN RELEVANCIA

Bats, emerging infectious diseases, and the rabies paradigm revisited

Ivan V. Kuzmin[1]*, Brooke Bozick[2], Sarah A. Guagliardo[2], Rebekah Kunkel[2], Joshua R. Shak[2], Suxiang Tong[1] and Charles E. Rupprecht[1]

Emerging Health Threats Journal 2011.

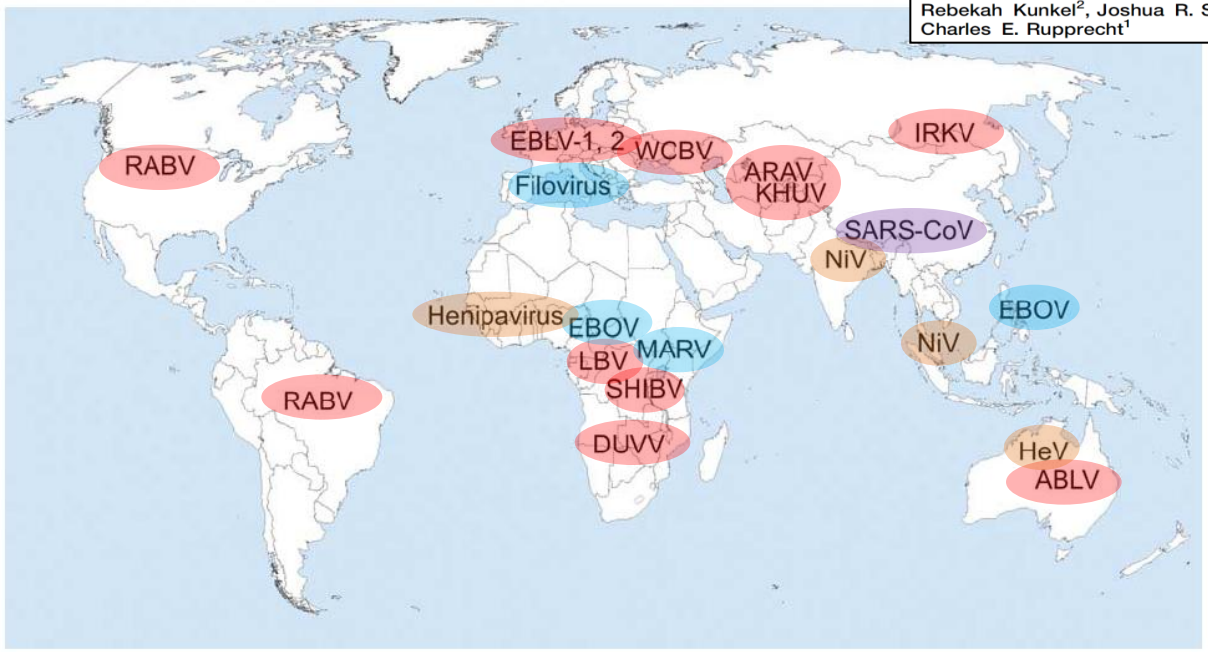


Fig. 1. Bat-associated and presumable bat-associated EIDs. Abbreviations: RABV, =rabies virus; EBLV-1,2 =European bat lyssaviruses type 1 and 2; WCBV =West Caucasian bat virus; ARAV =Aravan virus; KHUV =Khujand virus; IRKV =Irkut virus; LBV =Lagos bat virus; SHIBV =Shimoni bat virus; DUVV =Duvenhage virus; MARV =Marburg virus; EBOV =Ebola virus; Filovirus =unclassified filovirus detected in bats in Europe; HeV =Hendra virus; NiV =Nipah virus; Henipavirus =unclassified henipavirus; SARS-CoV =SARS coronavirus.

Patógenos Zoonóticos en Murciélagos

Paramyxovirus (gén. Henipavirus)

Hendra virus (HeV)

1994

Brote síndrome respiratorio agudo; 75% mortalidad

Síndrome gripal; 50% mortalidad

1996

2024 caballos; 2017 sero-, 7 sero+ de Hendra (Ward et a., 1996. Aust Vet J)

Confirmed HeV incidents (as of 15 October 2010)	
Location	Date
Mackay, Queensland	August 1994
Hendra, Queensland	September 1994
Cairns, Queensland	January 1999
Cairns, Queensland	October 2004
Townsville, Queensland	December 2004
Peachester, Queensland	June 2006
Murwillumbah, New South Wales	October 2006
Peachester, Queensland	June 2007
Cairns, Queensland	July 2007
Redlands, Queensland	June 2008
Proserpine, Queensland	July 2008
Cawarral, Queensland	August 2009
Bowen, Queensland	September 2009
Tewantin, Queensland	May 2010

1994-2010

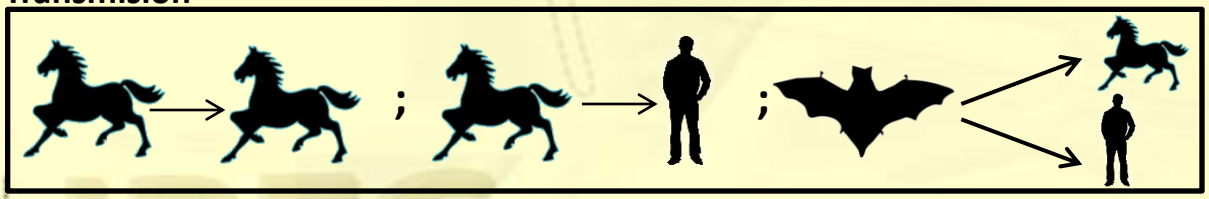
48 brotes en 

7 casos en 

Presentación clínica

↑ Tª y frec. cardíaca, fiebre, depresión, signos neurológicos y/o respiratorios, descarga nasal (a veces sanguinolenta), muerte en 2 días

Transmisión



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Patógenos Zoonóticos en Murciélagos

Paramyxovirus (gén. Henipavirus)

Hendra virus (HeV)

Fuente: http://en.wikipedia.org/wiki/Pteropus

The shading illustrates the diversity of this group - the darker the colour the greater the number of species. Data provided by **WWF's Wildfinder**.

Todas las especies de zorros voladores (género *Pteropus*) en Australia son seropositivas

Ausencia de signos clínicos

HeV en orina, fluidos post-parto, fetos abortados

Brotes HeV asociados a zonas atractivas para *Pteropus* – vínculo con casos en  y en 

HeV está presente en *Pteropus* en Australia y Papua Nueva Guinea

Patógenos Zoonóticos en Murciélagos

Paramyxovirus (gén. Henipavirus)

Nipah virus (NiV)

1998/99

Brote agudo; <5% mortalidad; 1 millón de cerdos sacrificados

Síndrome neurológico; 105 muertos; 70-90% mortalidad

>2001

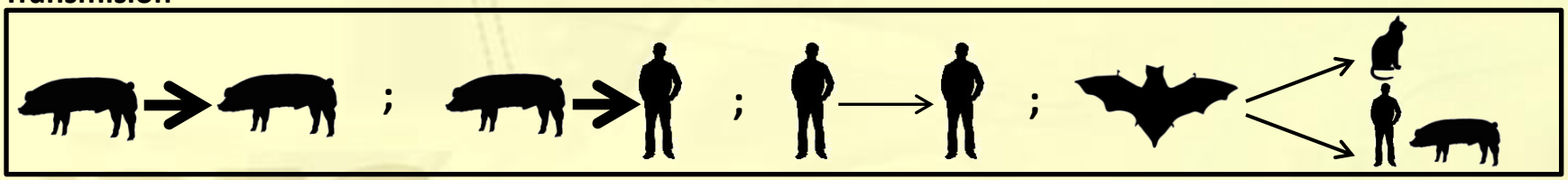
> 10 brotes de NiV; *Pteropus giganteus* como reservorio; Contaminación tuba de palma

Presentación clínica

Fiebre, signos nerviosos y/o respiratorios

Fiebre, dolor cabeza, desorientación, coma en 48 horas

Transmisión



Patógenos Zoonóticos en Murciélagos

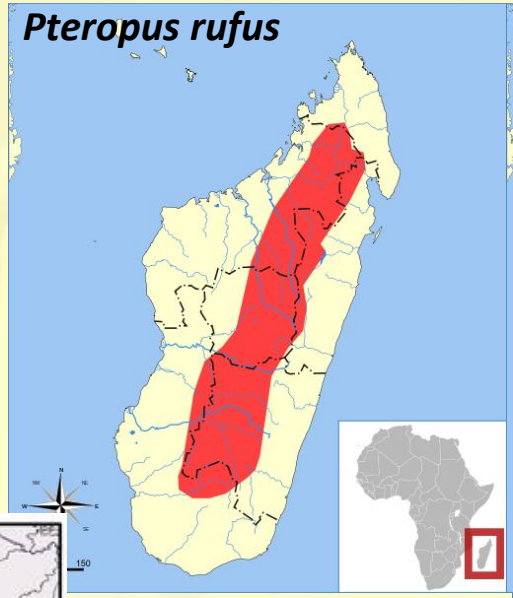
Paramyxovirus (gén. Henipavirus)

Nipah virus (NiV)

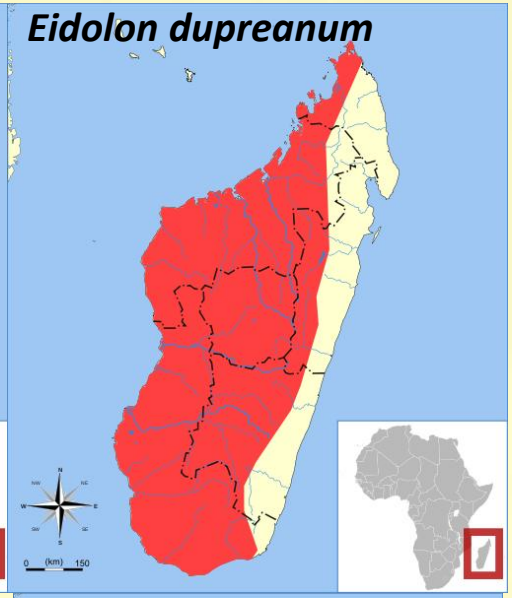
Pteropus giganteus

Fuente: http://es.wikipedia.org/wiki/Pteropus_giganteus

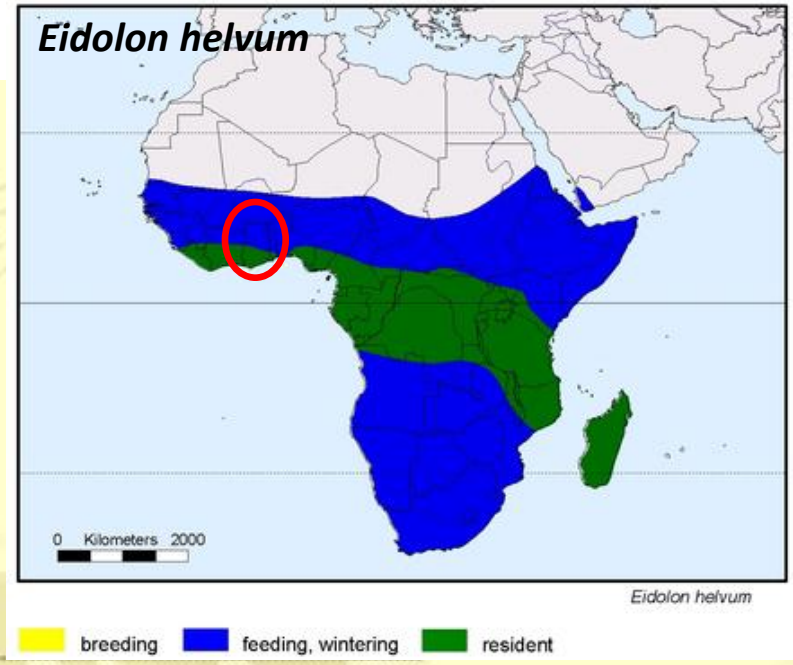
Pteropus rufus



Eidolon dupreanum



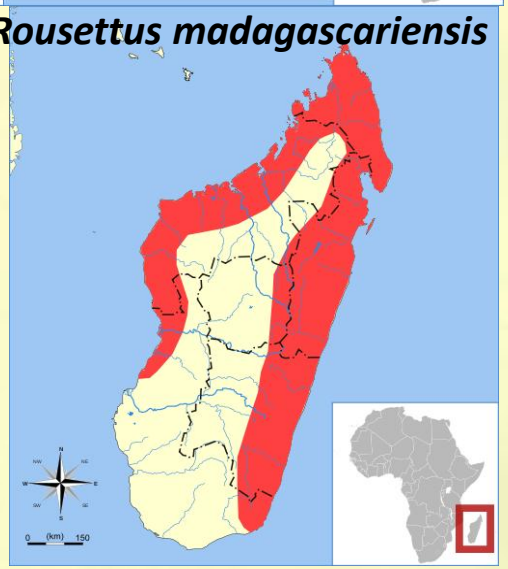
Eidolon helvum



Acs. NiV en otras especies de murciélagos frugívoros Africanas – no *Pteropus*

Henipavirus relacionados con NiV presentes en otras especies africanas de murciélagos

Rousettus madagascariensis



Patógenos Zoonóticos en Murciélagos

Paramyxovirus (gén. Henipavirus)

Zoonoses and Public Health

SPECIAL ISSUE – BATS

Henipaviruses: An Updated Review Focusing on the Pteropid Reservoir and Features of Transmission

B. A. Clayton[1,2], L. F. Wang[1] and G. A. Marsh[1]

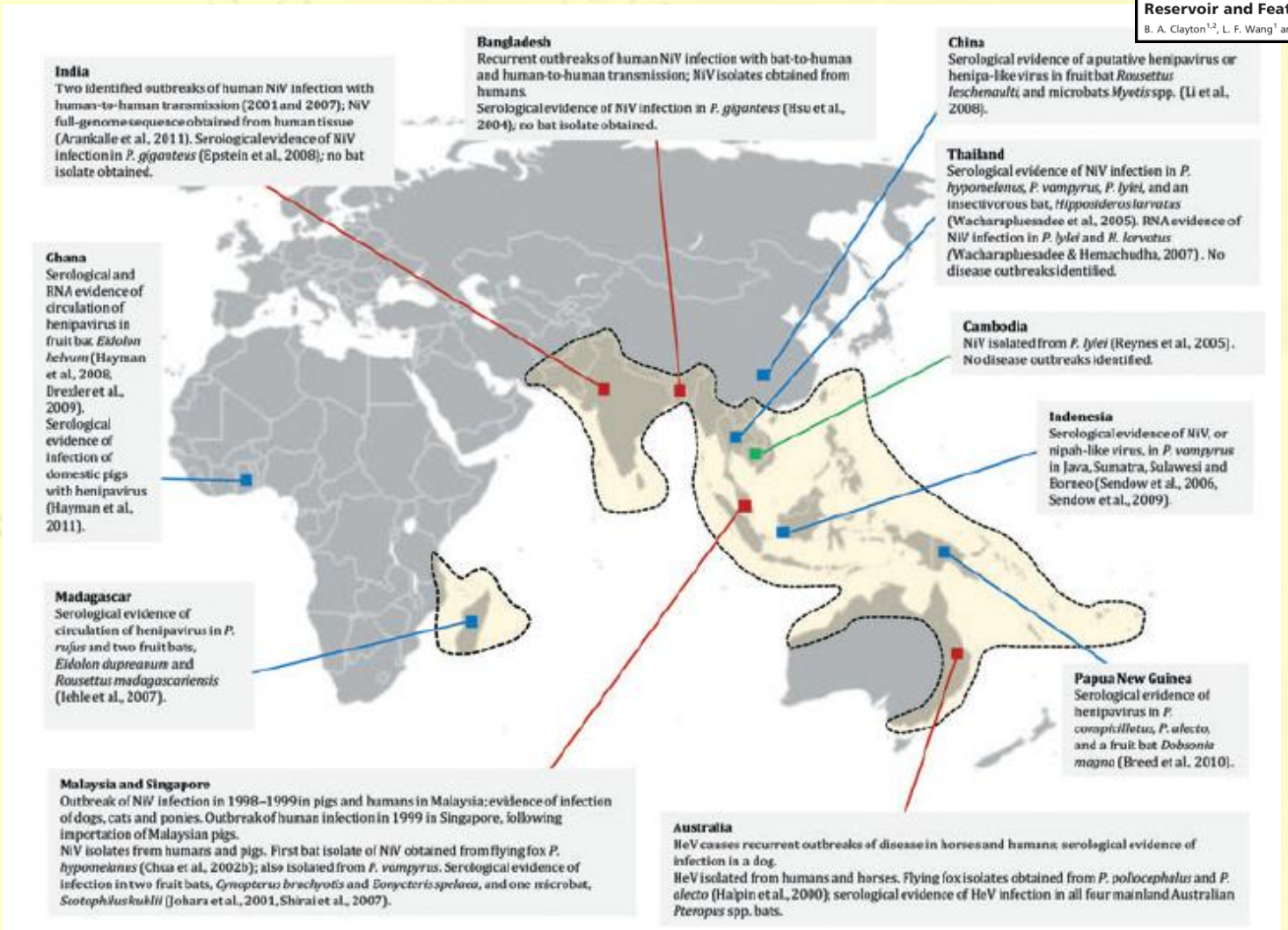
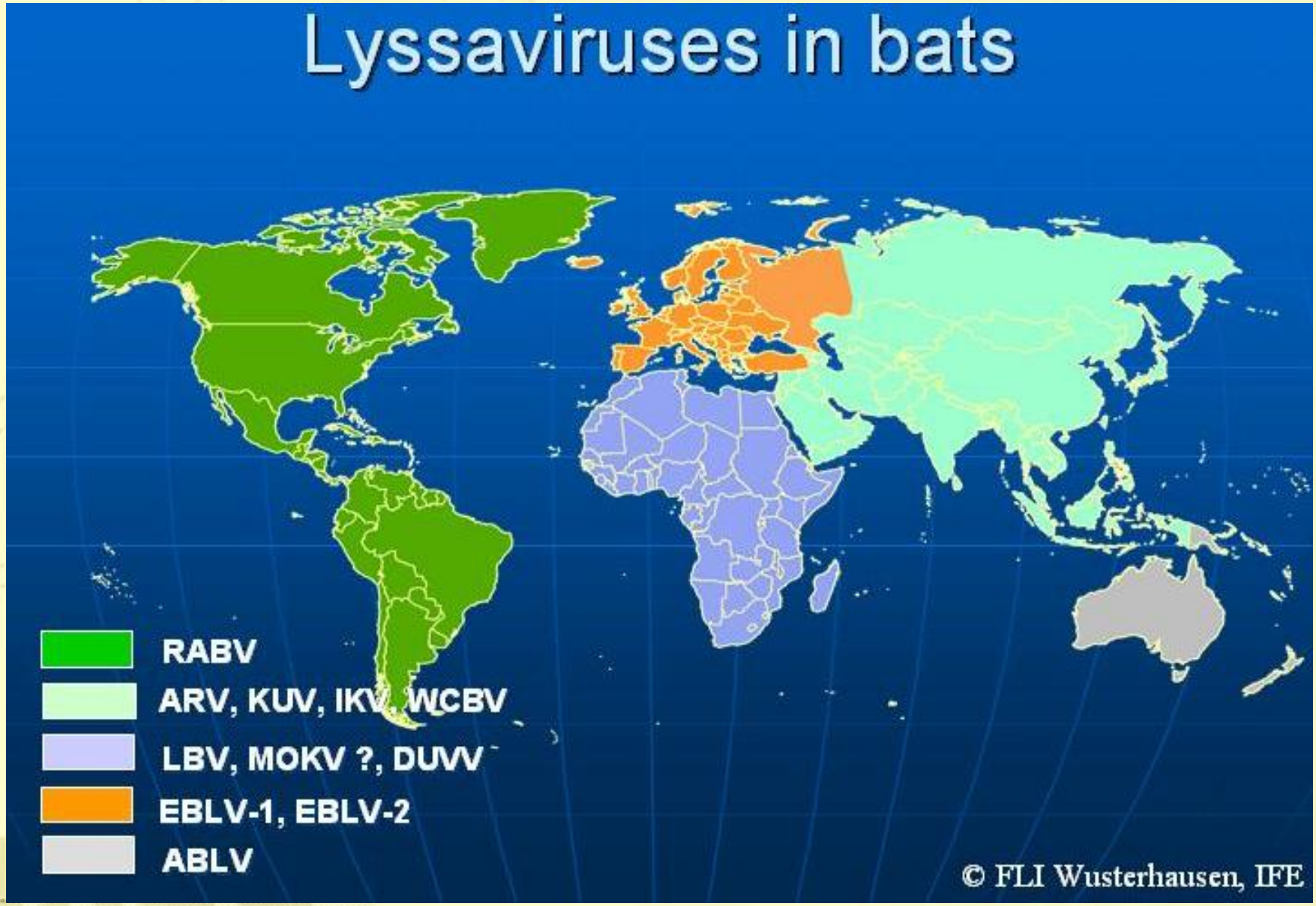


Fig. 1. Current known global distribution of the henipaviruses. The global range of bats in the genus *Pteropus*, described by (Hall and Richards, 2000), is depicted as shaded areas within the dotted line. Coloured lines represent: red: disease outbreaks documented; green: bat isolate obtained, no documented outbreaks; blue: evidence of infection (serological or RNA) in bats, no isolate obtained, no documented outbreaks.

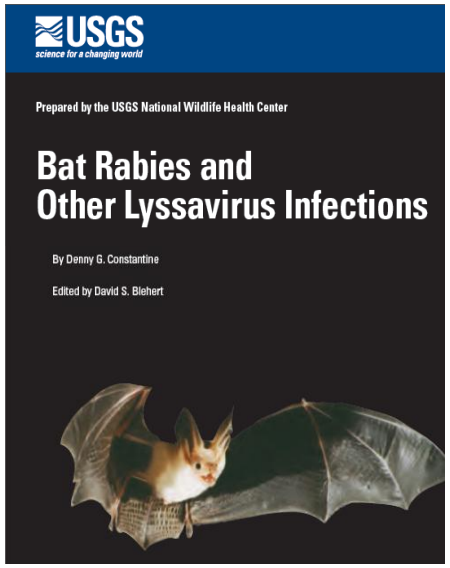
Patógenos Zoonóticos en Murciélagos

Lyssavirus



Patógenos Zoonóticos en Murciélagos

Lyssavirus



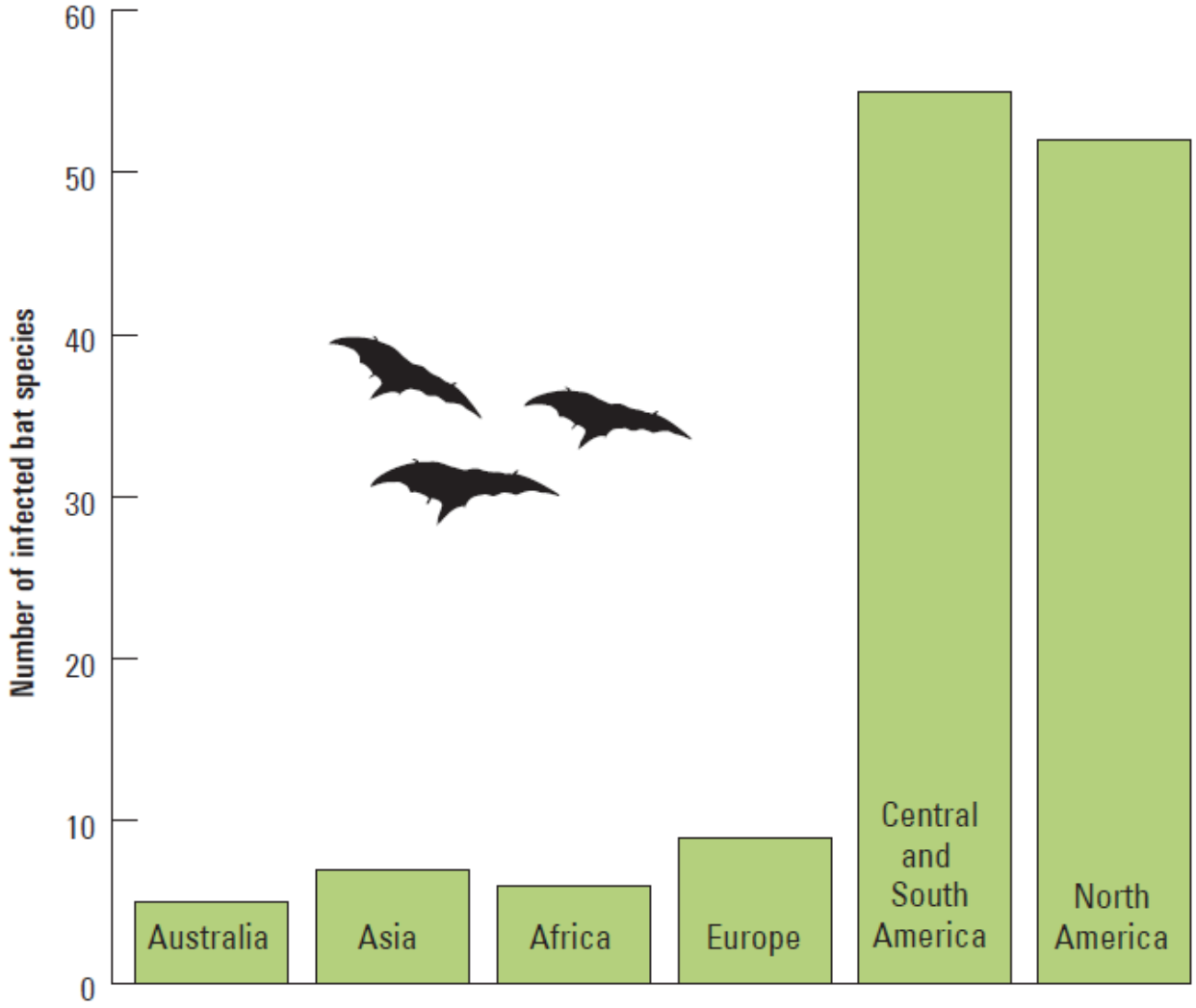


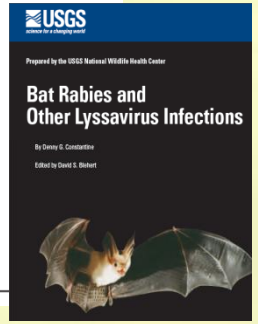
Figure 6. Number of rabies- and other lyssavirus-infected bat species by continent.

Patógenos Zoonóticos en Murciélagos

Lyssavirus

Table 1. Lyssavirus infections in mammals: agents, hosts, identification, and effectiveness of antirabies prophylaxis measures for humans.

Lyssavirus type		Known hosts		Diagnostic capabilities [3]	Effectiveness of antirabies prophylaxis for humans [4]
Name	Genotype	Reservoirs [1]	Victims		
Rabies	1	Carnivores, American bats	Humans, other mammals	Most government laboratories	Satisfactory.
Australian bat	7	Australian bats	Humans	Most government laboratories	Satisfactory.
European bat-2	6	European bats	Humans	Major regional	Reduced.
Irkut bat	Unclassified	Asian bats	Ferrets [2]	Major regional	Reduced.
Aravan bat	Unclassified	Asian bats	Hamsters [2]	Major regional	Reduced.
Khujand bat	Unclassified	Asian bats	Ferrets [2]	Major regional	Reduced.
European bat-1	5	European bats	Humans, cats, stone marten, sheep	Major regional	Poor.
Duvenhage bat	4	African bats	Humans	Major regional	Poor.
Mokola	2	African shrews and insectivorous rodents	Humans, dogs, cats	Major regional	None.
Lagos bat	3	African bats	Dogs, cats, mongooses	Major regional	None.
West Caucasian bat	Unclassified	Eastern European bats	Hamsters [2]	Major regional	None.



Patógenos Zoonóticos en Murciélagos

Lyssavirus

La mayor parte de *Lyssavirus* raramente causan rabia en humanos – exceptuando en Suramérica

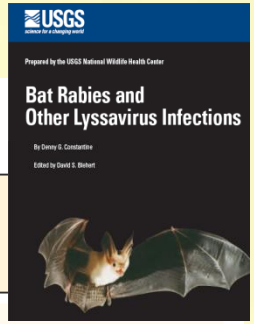
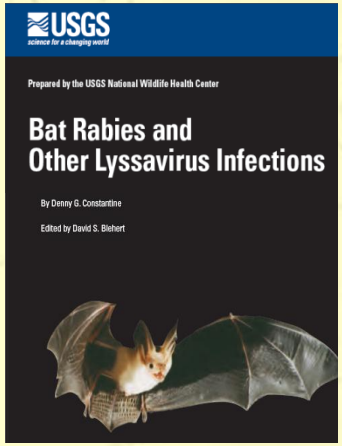


Table 7. Examples of nonbat species infected by rabid bats.

Species infected	Relative occurrence	Natural or laboratory infection	Comments
Cattle	Common	Natural and laboratory infection	Major vampire bat problem in Latin America.
Cats	Occasional	Natural and laboratory infection	Increasing problem, presumably by bat bite or bat ingestion.
Dogs	Rare	Natural and laboratory infection	Presumably by bat bite or bat ingestion.
Foxes	Rare	Natural and laboratory infection	By bat bite, bat ingestion, or aerosols in congested free-tailed bat caves.
Skunks	Rare	Natural and laboratory infection	Presumably by bat bite or bat ingestion.
Coyotes	Rare	Laboratory infection and presumed in nature	By bat bite, bat ingestion, or aerosols in congested free-tailed bat caves.
Laboratory mice	Only in laboratory	Laboratory infection	By bat bite.

Patógenos Zoonóticos en Murciélagos

Lyssavirus



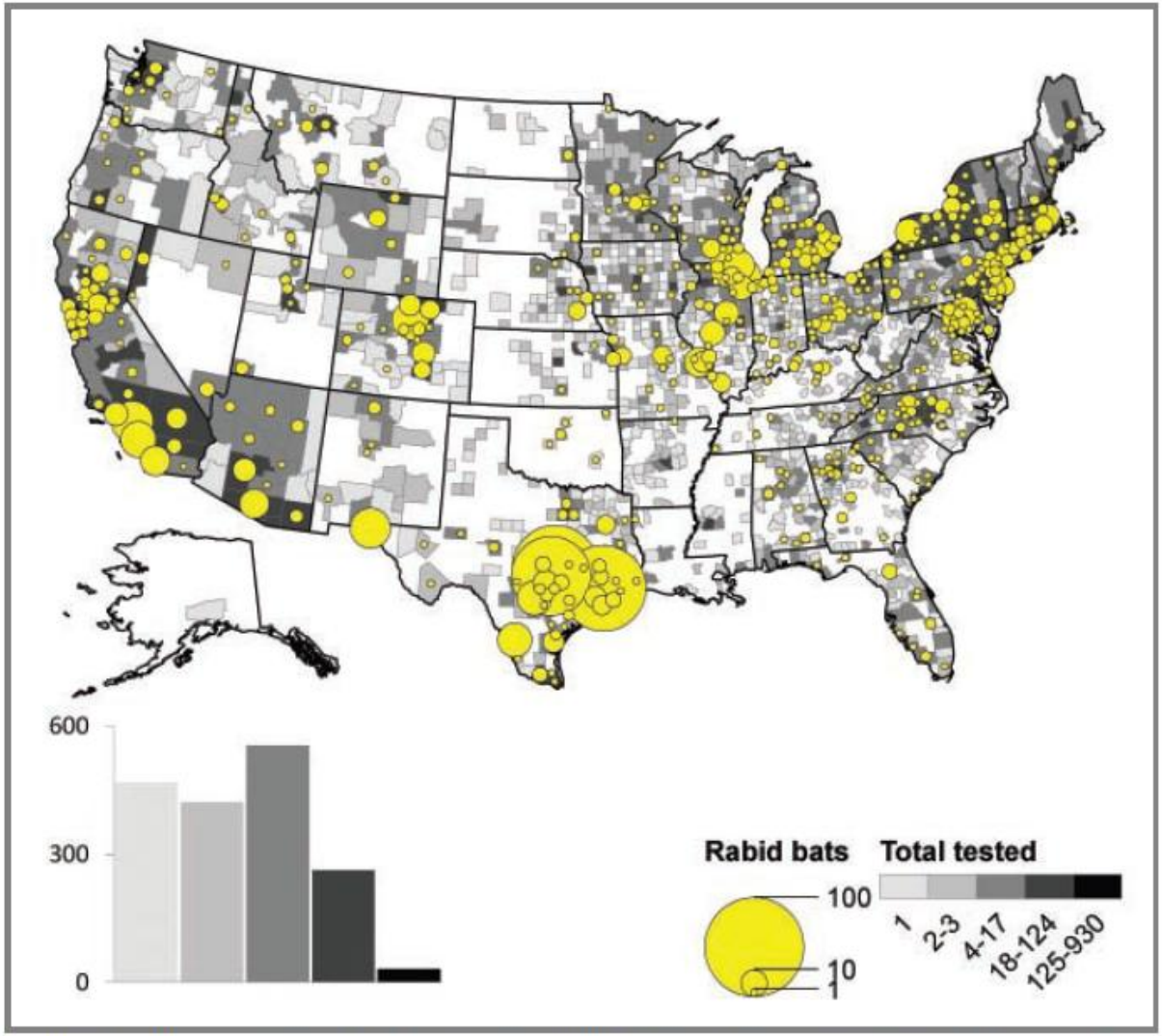


Figure 4—Reported cases of rabies involving bats, by county, 2010. Histogram represents numbers of counties in each category for total number of bats submitted for testing.

Patógenos Zoonóticos en Murciélagos

Lyssavirus

Vampiro común (Desmondus rotundus)

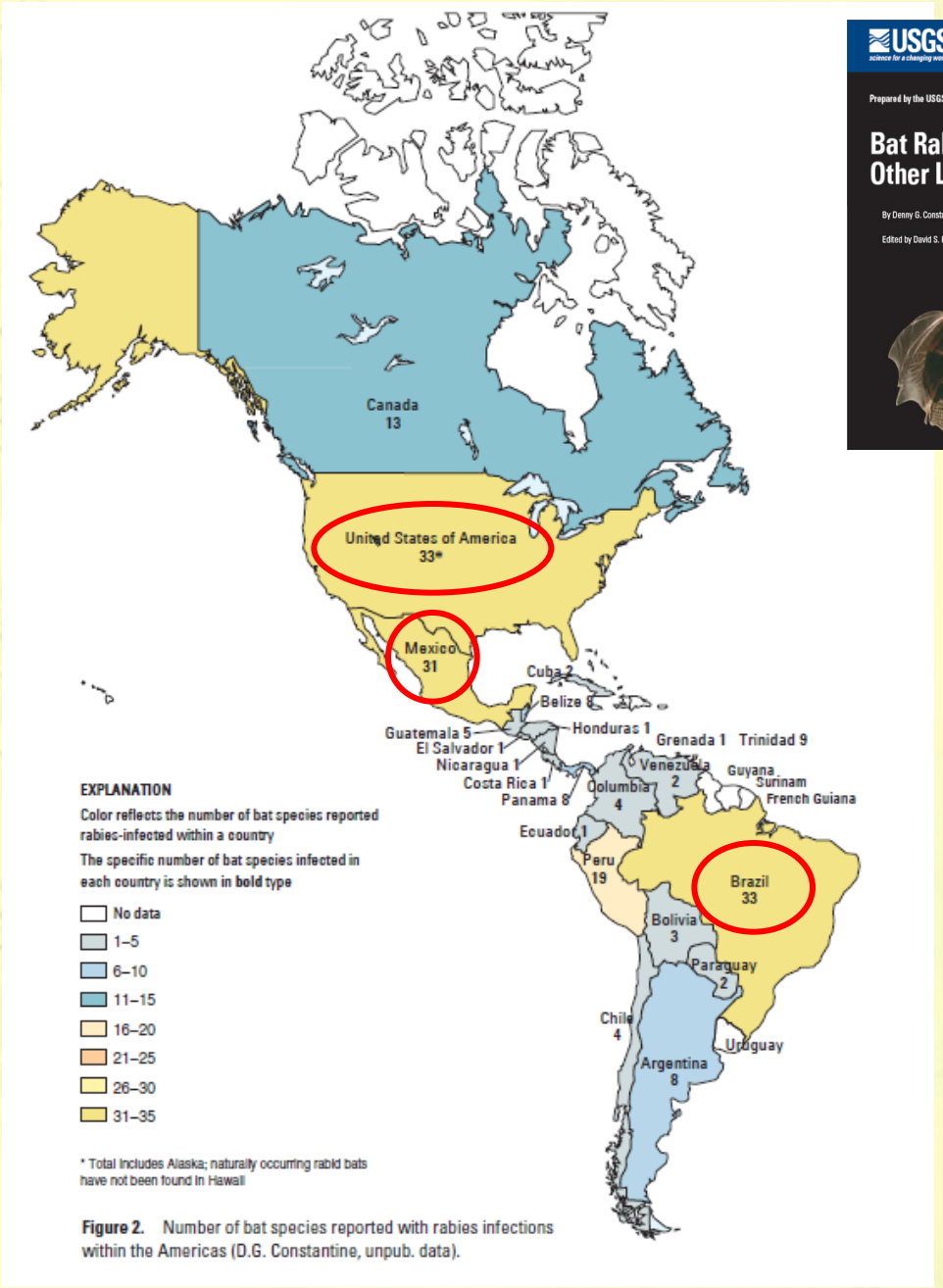
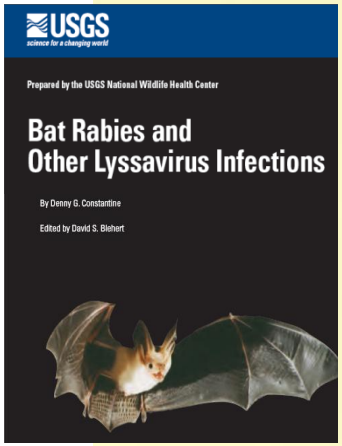


Figure 2. Number of bat species reported with rabies infections within the Americas (D.G. Constantine, unpub. data).



Patógenos Zoonóticos en Murciélagos

Lyssavirus

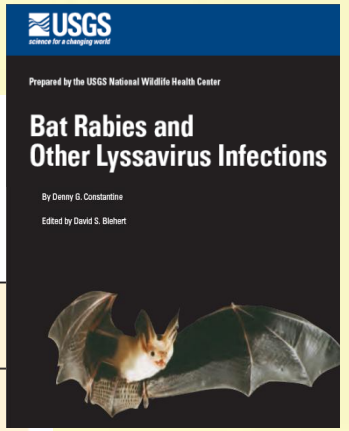
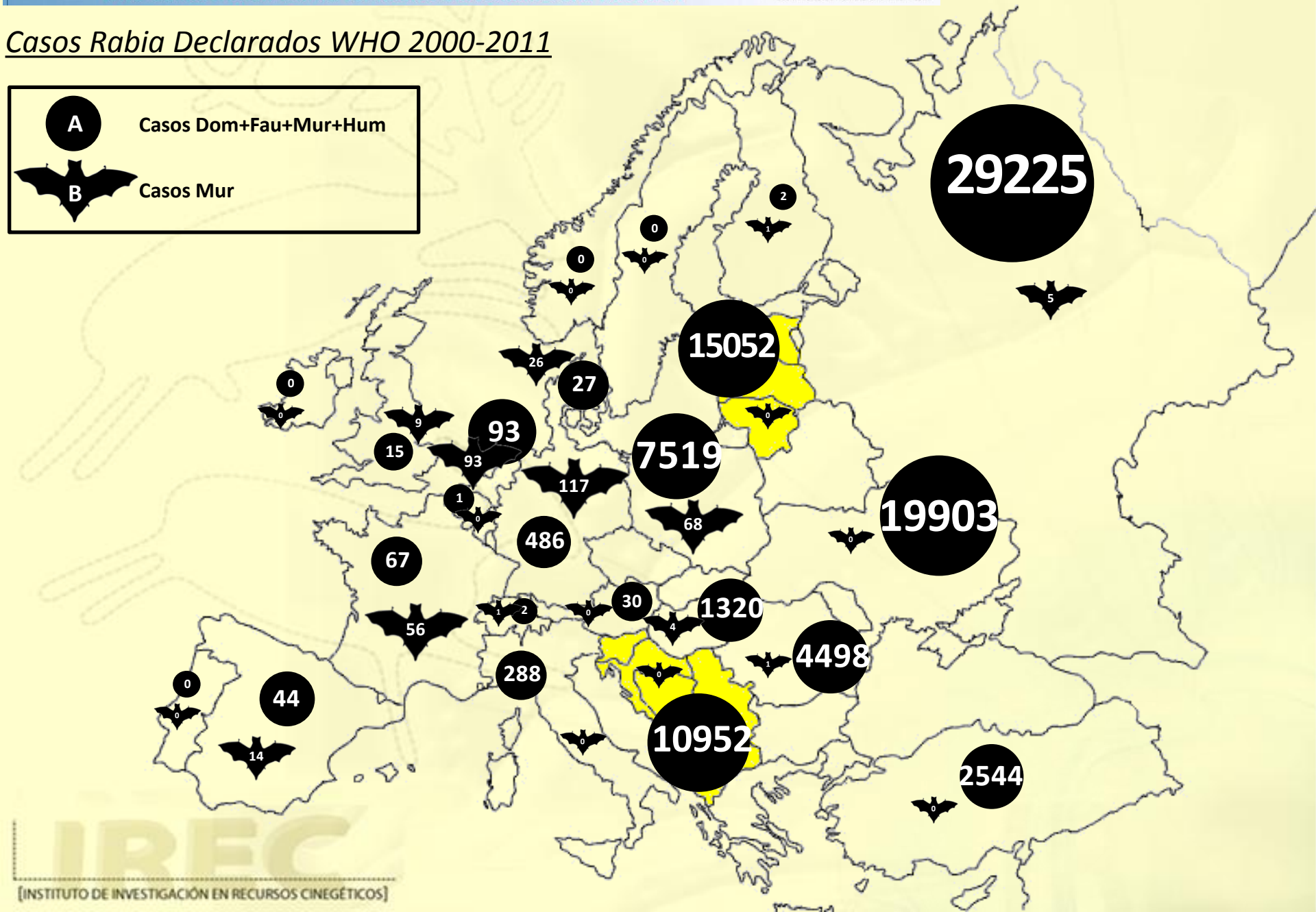


Table 2. General geographic area of rabies-related lyssavirus infections reported in bats.

[Unknown indicates that the lyssavirus species was known only to be rabies-related]

Lyssavirus species	Number of bat species reported infected					
	Africa	Australia	Asia	Europe	Indian subcontinent	Middle East
Aravan			1			
Australian		5				
Duvenhage	1					
European-1				9		
European-2				7		
Irkut			1			
Khujand			1			
Lagos	4					1
West Caucasion				1		
Unknown	1		3	7	2	1

Casos Rabia Declarados WHO 2000-2011



Patógenos Zoonóticos en Murciélagos

Lyssavirus

DISPATCHES

Phylogeny of European Bat Lyssavirus 1 in *Eptesicus isabellinus* Bats, Spain

Sonia Vázquez-Morón, Javier Juste, Carlos Ibáñez, José M. Berciano, and Juan E. Echevarría

Author affiliations: Instituto de Salud Carlos III, Majadahonda, Madrid, Spain (S. Vázquez-Morón, J.M. Berciano, J.E. Echevarría); Centro de Investigación Biomédica de Epidemiología y Salud Pública, Barcelona, Spain (S. Vázquez-Morón, J.E. Echevarría); and Consejo Superior de Investigaciones Científicas Estación Biológica de Doñana, Seville, Spain (J. Juste, C. Ibáñez)

Murciélago hortelano (E. serotinus)

Figure 2. Geographic distribution of *Eptesicus serotinus* bats (red), *E. isabellinus* bats (blue), and cases of rabies in bats (dots), Europe, 1990–2009. Obtained from Rabies Bulletin Europe (www.who-rabies-bulletin.org/).

Patógenos Zoonóticos en Murciélagos

Lyssavirus

Table 5. Bat species positive for *Lyssavirus*, Europe, 1954–2000[a]

Family	Species	Lyssavirus [b]	Antibodies [c]
Vespertilionidae	*Eptesicus serotinus*	EBL1a & b	EBL1
	Pipistrellus pipistrellus	NC	ND
	Pipistrellus nathusii	NC	ND
	Vespertilio murinus	EBL1a	ND
	Myotis dasycneme	EBL2a	ND
	Myotis daubentonii	EBL2a & b	ND
	Myotis myotis	EBL1b	EBL1
	Myotis nattereri	EBL1b	ND
	Nyctalus noctula	NC	ND
	Miniopterus schreibersii	EBL1b	EBL1
Molossidae	*Tadarida teniotis*	NC	EBL1
Rhinolophidae	*Rhinolophus ferrumequinum*	EBL1b	EBL1

[a]The additional information was obtained from Kappeler (29), Pérez-Jordá et al. (24), Amengual et al. (5), Bulletin épidemiologique mensuel de la rage en France (30), and Muller (2).
[b]NC = not characterized.
[c]ND = not done.

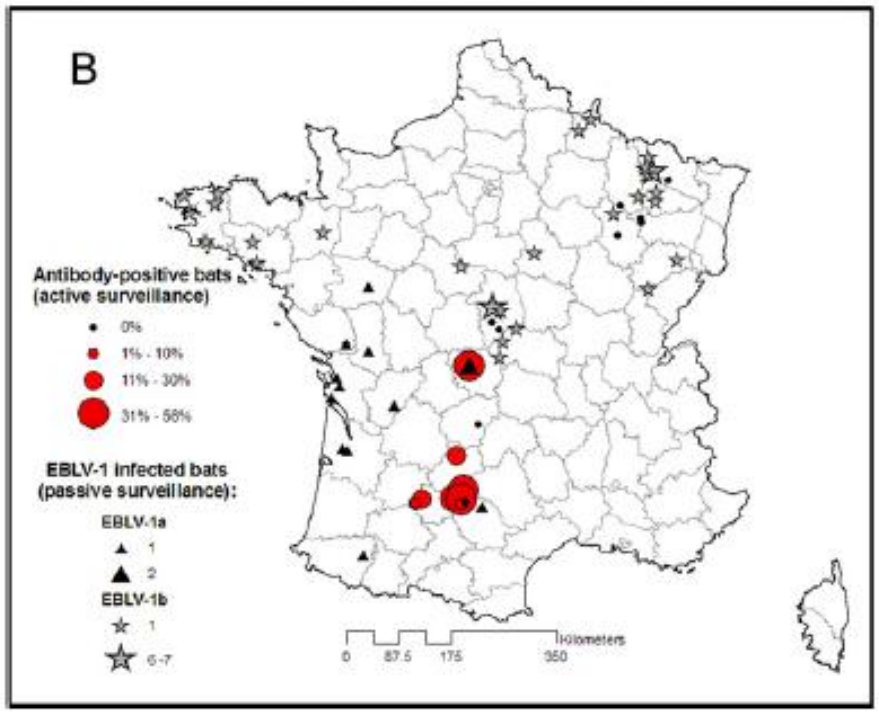
Patógenos Zoonóticos en Murciélagos

Lyssavirus

Veterinary Microbiology 151 (2011) 390–395

Active surveillance of bat rabies in France: A 5-year study (2004–2009)

Evelyne Picard-Meyer [a,*], Marie-Jo Dubourg-Savage [b], Laurent Arthur [b], Michel Barataud [b], David Bécu [b], Sandrine Bracco [b], Christophe Borel [b], Gérald Larcher [b], Benjamin Meme-Lafond [b], Marie Moinet [a], Emmanuelle Robardet [a], Marine Wasniewski [a], Florence Cliquet [a]



European Bat *Lyssavirus* Infection in Spanish Bat Populations

Jordi Serra-Cobo,* Blanca Amengual,† Carlos Abellán,‡ and Hervé Bourhy†

Emerging Infectious Diseases • Vol. 8, No. 4, April 2002

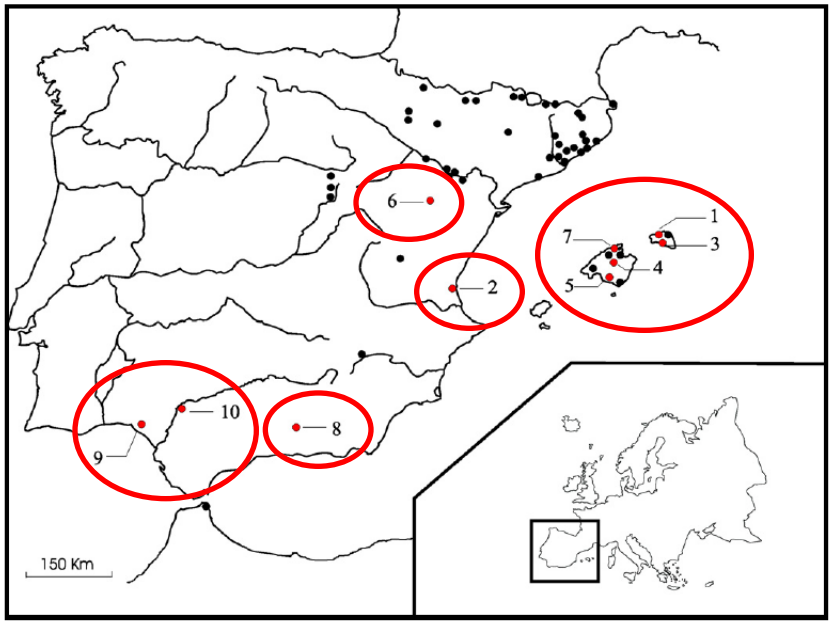


Figure 1. Map showing the localities in Spain where bats have been analyzed. 1. Ciutadella; 2. El Saler; 3. Ferreries; 4. Inca; 5. Llucmajor; 6. Oliete; 7. Pollença; 8. Granada; 9. Huelva; 10. Sevilla. Points in red indicate colonies where positive results were obtained according to our study (Localities Nos. 1, 3, 4, 5, 6, and 7) and previous studies (Localities Nos. 2, 8, 9, and 10) (7).

Patógenos Zoonóticos en Murciélagos

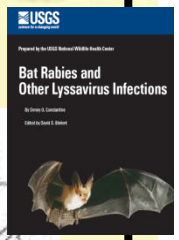
Coronavirus

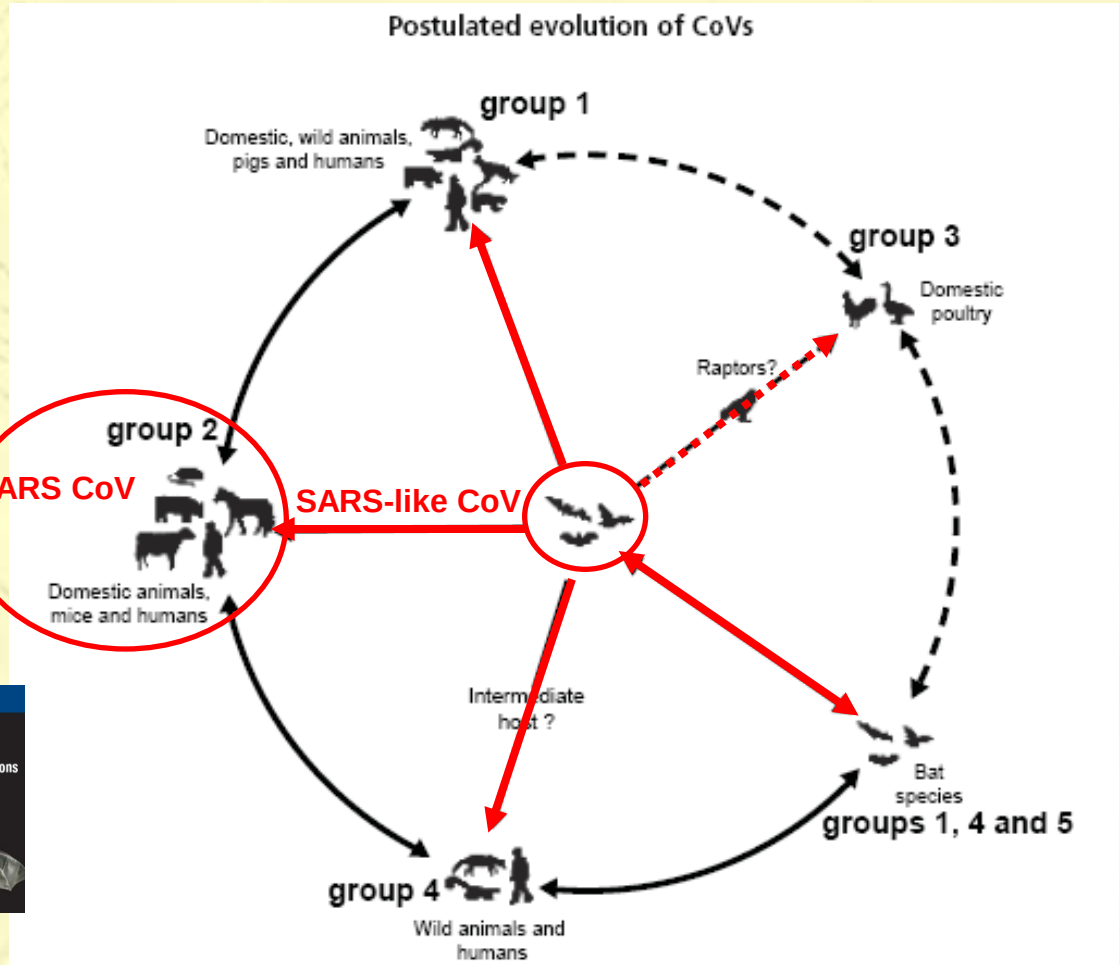
2002 – Epidemia de SARS en Sudeste Asia

Diseminación Mundial (32 países) --- **8000** Infectados y **800** muertos

43 especies murciélagos + CoV o acs. anti-CoV

CoV g1 y g2 en gran diversidad spp.





All animal and human CoVs (groups 1, 2, 4 and 5, also known as groups 1, 2a, 2b and 2c) evolved from the interspecies transmission of CoVs from bats (solid lines). Interspecies transmission and evolution of group 3 CoVs in poultry possibly resulted via an intermediary host such as a raptor (dashed lines) preying on bats and poultry.

Source: Vijaykrishna *et al.*, 2007.

Patógenos Zoonóticos en Murciélagos

Filovirus (Ebola y Marburg)

1967 – Marburg virus (MbV)
1976 – Ebola virus (EbV)

Epidemiología y clínica

2600 infectados conocidos hasta 2009 – 72% fatalidad (0%-90% según virus)
Zaire EbV y **Lake Victoria MbV** – altamente patógenos (80-90% mortalidad)
Sudan y **Bundibugyo EbV** – 43-50% mortalidad
Reston EbV – Apatógeno en humanos
Fiebre, escalofríos, mialgia, malestar gral., letargia, naúseas, vómitos, dolor abdominal, anorexia, diarrea, tos, dolor cabeza, hipotensión, ocasionalx. signos hemorrágicos, coma, muerte.

Ecology of Marburg and Ebola Viruses: Speculations and Directions for Future Research

Thomas P. Monath

The Journal of Infectious Diseases 1999; 179(Suppl 1):S127–38

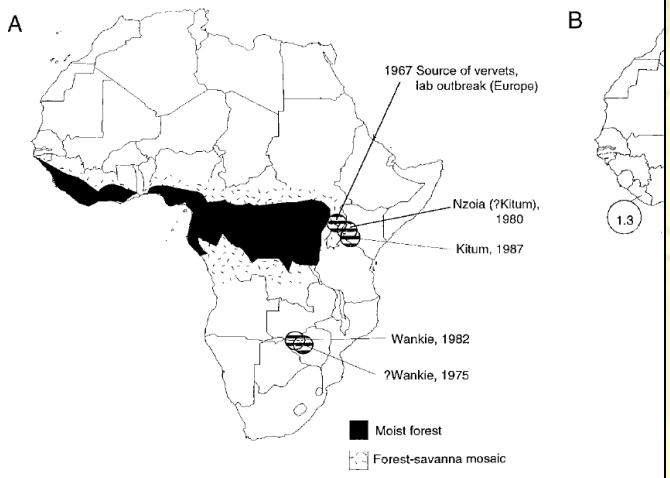


Figure 1. Distribution of Marburg virus disease incidents reported in Africa, 1967–1996 (by IFA in various surveys [38, 42–45, 47, 58–62] (**B**). lab = laboratory. Nzoia (Mt. Elgon)

Table 1. Marburg virus disease outbreaks and cases, showing potential and known sources of infection.

Year	Place	Event	Risk factors	Possible source	Reference
1967	Germany, Yugoslavia	Outbreak, laboratory workers	Blood and tissues of monkeys	*Cercopithecus aethiops* (Uganda)	[10, 11]
1975	Zimbabwe (?Wankie)	Sporadic case	Slept and hiked outdoors	Lycosid spiders; other biting/stinging arthropods; *Gonimbrasia bellina* larvae; bat, bird, and rodent excreta; eland (*Taurotragus oryx*) meat?	[14–16]
1980	Kenya (Mt. Elgon)	Sporadic case	Kitum cave	Bat excreta or ectoparasites; biting arthropods in and around cave; other vertebrate excreta or ectoparasites	[18]
			Sugar factory	Spiders	
			Home environment	Crow (*Corvus albus*)	
			Forests around home	Arthropods, vertebrates	
			Human contact	Seropositive maid (no illness)	
1982	Zimbabwe (Wankie)	Sporadic case	?		[17]
1987	Kenya (Mt. Elgon)	Sporadic case	Kitum cave	Bat excreta or ectoparasites	*
			Rocky ledges near cave	Bird excreta or ectoparasites; biting arthropods in and around cave; other vertebrate excreta or ectoparasites	

* Johnson ED, personal communication, 1996.

Patógenos Zoonóticos en Murciélagos

Filovirus (Ebola y Marburg)

Review TRENDS in Microbiology Vol.15 No.9

The ecology of Ebola virus

Allison Groseth[1], Heinz Feldmann[1,2] and James E. Strong[1,2,3]

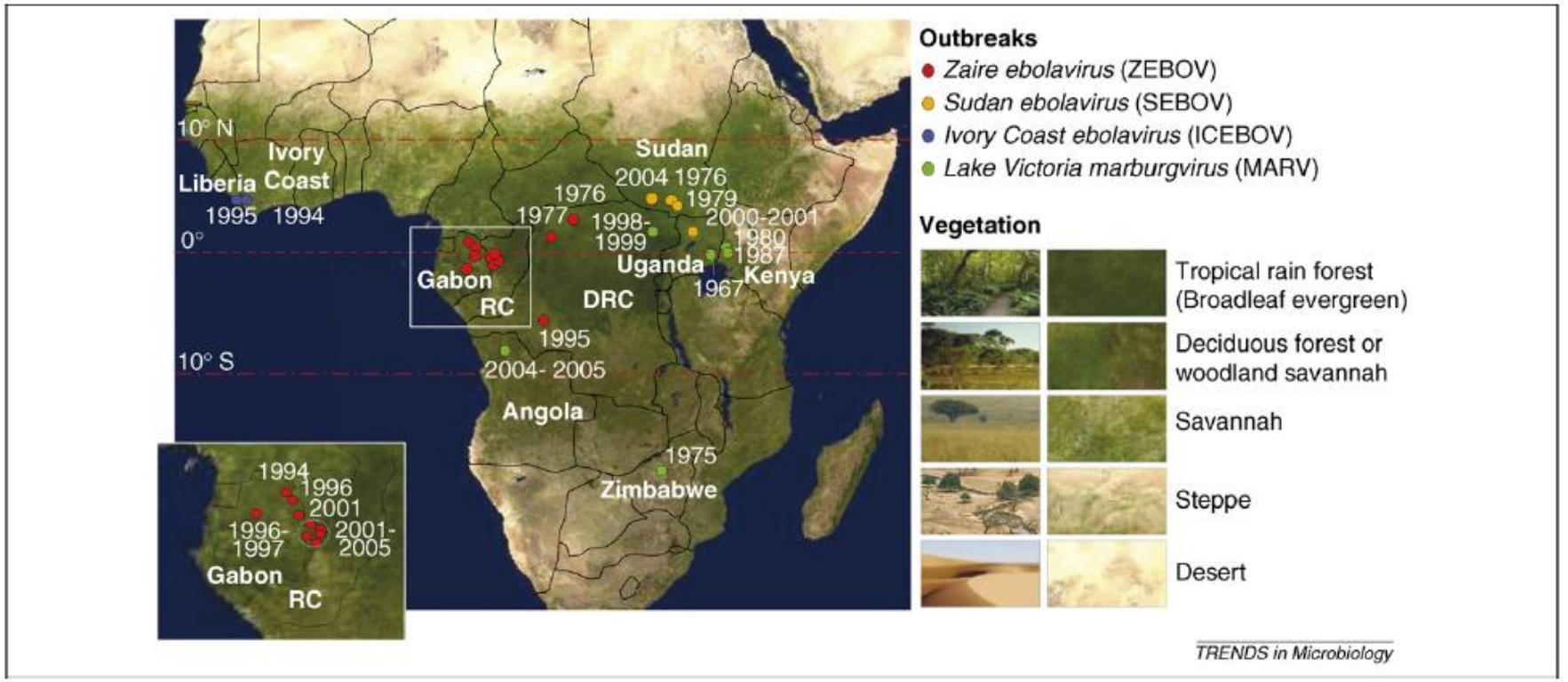
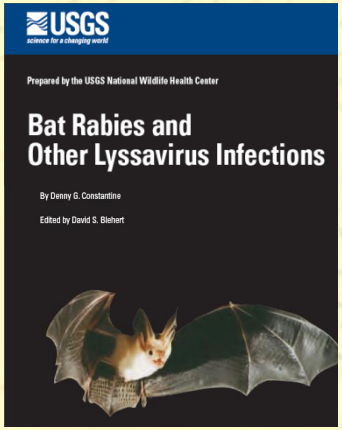


Figure 1. Spatial distribution of human filovirus outbreaks in relation to geographical conditions. The political boundaries and the names of the countries where Ebola virus or Marburg virus outbreaks have been reported are indicated, as are the relevant lines of latitude. The site of each Ebola virus or Marburg virus outbreak is also indicated, as well as the year in which the outbreak occurred. Color patterns in the satellite image are shown at the side, correlated to the ecological conditions they represent.

Patógenos Zoonóticos en Murciélagos

Filovirus (Ebola y Marburg)



Filovirus outbreaks in humans

	Date	Location	Cases	Fatality (%)
Zaire ebolavirus	1976	Zaire (now DRC)	318	88
	1977	Zaire (now DRC)	1	100
	1994	Gabon	49	65
	1995	DRC	315	88
	1996 (spring)	Gabon	37	57
	1996 (autumn)[a]	Gabon	60	75
	2001-2002	Gabon, Rep. of Congo	123	79
	2003 (spring)	Rep. of Congo	143	90
	2003 (autumn)	Rep. of Congo	35	83
	2005	Rep. of Congo	12	75
	2007	DRC	264	71
	2008	DRC	32	47
Sudan ebolavirus	1976	Sudan	284	53
	1979	Sudan	34	65
	2000	Uganda	425	53
	2004	Sudan	17	42
Côte d'Ivoire ebolavirus	1994	Côte d'Ivoire	1	0
Reston ebolavirus	1989-1990	United States of America	4	0
	1992	Italy	0	0
	1996	United States of America	0	0
	2008	Philippines	6	0
Bundibugyo ebolavirus	2007-2008	Uganda	131	40
Marburgvirus	1967	Germany, (Former) Yugoslavia, via Uganda	31	23
	1975[a]	Zimbabwe, South Africa	3	75
	1980	Kenya	2	50
	1987	Kenya	1	100
	1998-2000	DRC	154	83
	2005	Angola	252	90
	2007[b]	Uganda	4	25
	2007[c]	Uganda	1	0
	2008[c]	Uganda	1	100

[a] Subsequent transmission to a health care worker in South Africa.
[b] Linked to Kitaka mine, Ibanda, Uganda.
[c] Linked to Python Cave, Queen Elizabeth National Park, Uganda.

Patógenos Zoonóticos en Murciélagos

Filovirus (Ebola y Marburg)

Ecology of Marburg and Ebola Viruses: Speculations and Directions for Future Research

Thomas P. Monath

The Journal of Infectious Diseases 1999; 179(Suppl 1):S127–38

Table 2. Bats potentially implicated in Marburg (MBG) virus transmission by virtue of cave roosting habits and cave exposure of humans who acquired MBG in Kenya in 1980 and 1987. Distribution elsewhere within known range of MBG virus (Uganda and Zimbabwe) is shown.

		Roosting habitat in Kenya			Present in			
Bat, common name	Genus and species	Caves	Forest and savanna	Buildings	Uganda	Zimbabwe	Diet	Abundance
Rousette	*Rousettus lanosus*	++++	+		+		FR	M
	Rousettus aegypticus	++++	+		+	+	FR	H
Straw-colored	*Eidolon helvum*	++	++++		+	+	FR	H
Hammer-headed	*Hypsignathus monstrosus*	+	++++		+		FR, ?V	L
Long-tongued	*Megaloglossus woermeri*	+	+++		+		FR	L
Tomb	*Taphozous mauritanius*	++++	++	+	+	+	I (F)	M
Sheath-tailed	*Coleura afra*	++++		+	+	+	I	H
Slit-faced	*Nycteris* species	+++	+++	+	+	+	I (T, F), V	M
Horseshoe	*Rhinolophus* species	++++	++++	+	+	+	I (T, F)	H
Leaf-nosed	*Hipposideros* species	++++	++	+	+	+	I (T, F)	H
Triple nose-leaf	*Triaenops persicus*	++++			+	+	I	L/M
Little brown	*Myotis welwitschii, Myotis tricolor*	++++	+++	+	+	+	I	L
Pipistrelles	*Pipistrellus* species	+	++++	+	+	+	I (F)	H
Big brown	*Eptesicus hottentotus*	++	++	+	+	+	I	L
Lesser broad-nosed	*Scotorepens hirundo*	+	+++	+	+	+	I (T, F)	L
Long-winged	*Miniopterus* species	++++	+	+	+	+	I (F)	H
Mastiff	*Chaerephon* species; *Mops* species	++++	+++	+	+	+	I (F)	H
Big-eared free-tail	*Otomops martiensseni*	++++		+	+	+	I	M

NOTE. FR = frugivorous; V = vertebrates; I = insectivorous; I (F) = flying insects; I (T) = terrestrial arthropods (spiders, scorpions, and others); H = high; M = moderate; L = low; + = rare; ++ = occasional; +++ = frequent; ++++ = typical habitat.

Patógenos Zoonóticos en Murciélagos

Filovirus (Ebola y Marburg)

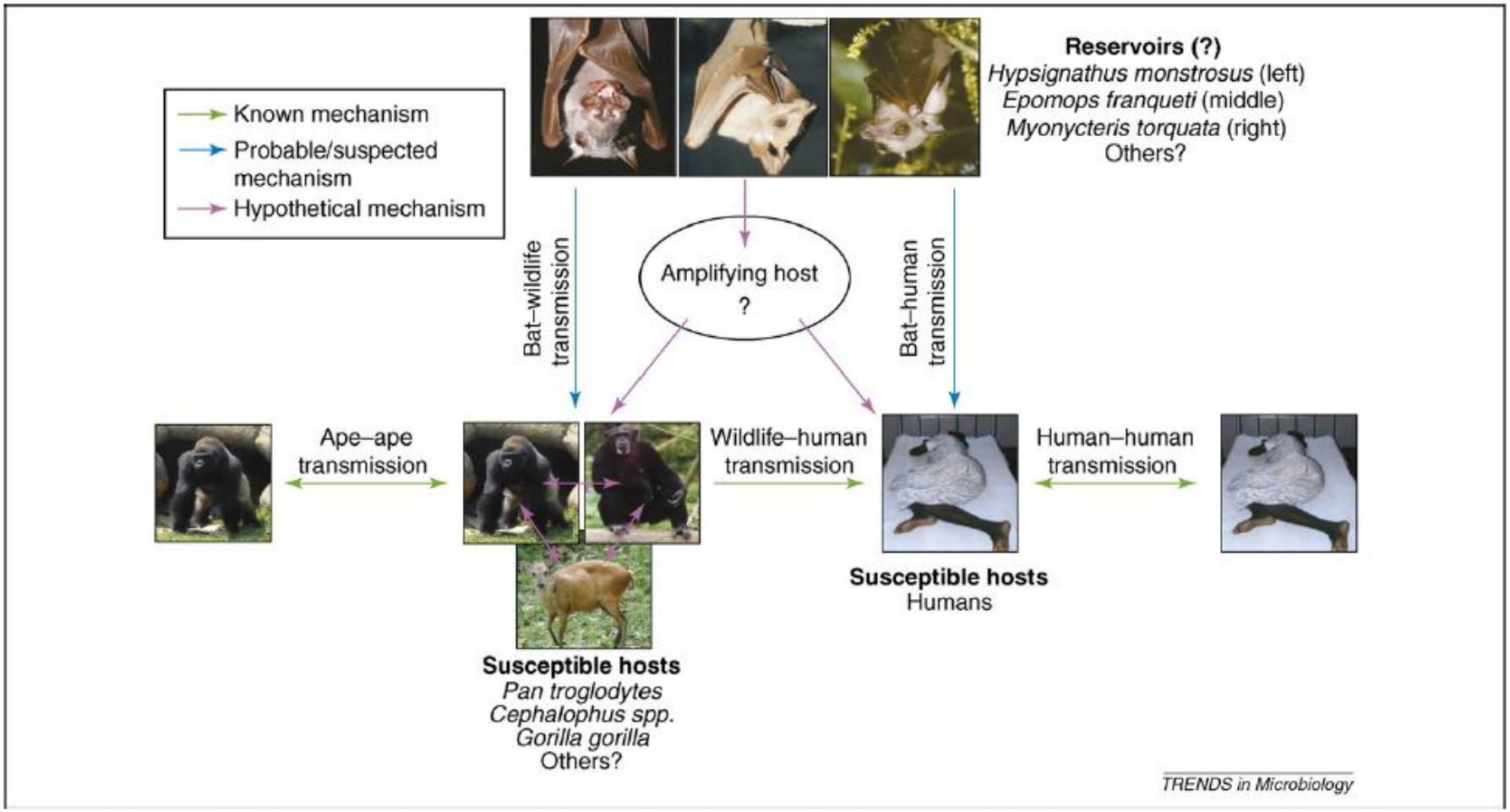


Figure 3. Mechanisms of filovirus transmission in nature. Known and hypothesized mechanisms of transmission between reservoir, potential amplifying hosts and susceptible hosts, including humans, are summarized. Arrow colors indicate whether the transmission follows a known (green arrow), suspected (blue arrow) or hypothetical mechanism (purple arrow).

Patógenos Zoonóticos en Murciélagos

Filovirus (Ebola y Marburg)

Table 1. Routes of transmission involved in known Ebola virus outbreaks

Year	Country	Species	Start date	Source of infection
1976	DRC[a]	Zaire	September[c]	Unknown. Index case was a mission school teacher.
1976	Sudan	Sudan	June[c]	Worker in a cotton factory. Evidence of bats at site.
1977	DRC	Zaire	June [63]	Unknown (retrospective).
1979	Sudan	Sudan	July [17]	Worker in cotton factory. Evidence of bats at site.
1994	Gabon	Zaire	December [64]	Gold-mining camps. Evidence of bats at site.
1994	Ivory Coast	Ivory Coast	November[c]	Scientist performing autopsy on a dead wild chimpanzee.
1995	Liberia	Ivory Coast	December [19]	Unknown. Refugee from civil war.
1995	DRC	Zaire	January [65]	Index case worked in a forest adjoining the city.
1996	Gabon	Zaire	January[c]	People involved in the butchering of a dead chimpanzee became ill.
1996-1997	Gabon	Zaire	July[c]	Index case was a hunter living in a forest camp.
2000–2001	Uganda	Sudan	September[c]	Unknown.
2001–2002	Gabon	Zaire	October[c]	Contact with dead or butchered great apes and/or other wildlife.
2001–2002	RC[b]	Zaire	October[c]	Contact with dead or butchered great apes and/or other wildlife.
2002–2003	RC	Zaire	December[c]	Contact with dead or butchered great apes and/or other wildlife.
2003	RC	Zaire	November[c]	Contact with dead or butchered great apes and/or other wildlife.
2004	Sudan	Sudan	May [66]	Unknown.
2005	RC	Zaire	April [18]	Unknown.

[a]Democratic Republic of Congo.
[b]Republic of Congo.
[c]WHO Ebola Hemorrhagic Fever Fact Sheet (http://www.who.int/mediacentre/factsheets/fs103/en/) accessed 30 May 2007.

Review TRENDS in Microbiology Vol.15 No.9

The ecology of Ebola virus

Allison Groseth[1], Heinz Feldmann[1,2] and James E. Strong[1,2,3]

Patógenos Zoonóticos en Murciélagos

Filovirus (Ebola y Marburg)

Myotis myotis

Miniopterus schreibersii

OPEN ACCESS Freely available online PLoS PATHOGENS

Discovery of an Ebolavirus-Like Filovirus in Europe

Ana Negredo[19], Gustavo Palacios[29]*, Sonia Vázquez-Morón[1], Félix González[3], Hernán Dopazo[4], Francisca Molero[1], Javier Juste[5], Juan Quetglas[5], Nazir Savji[2], Maria de la Cruz Martínez[1], Jesus Enrique Herrera[2], Manuel Pizarro[6], Stephen K. Hutchison[7], Juan E. Echevarría[1], W. Ian Lipkin[2¶], Antonio Tenorio[1¶]

B

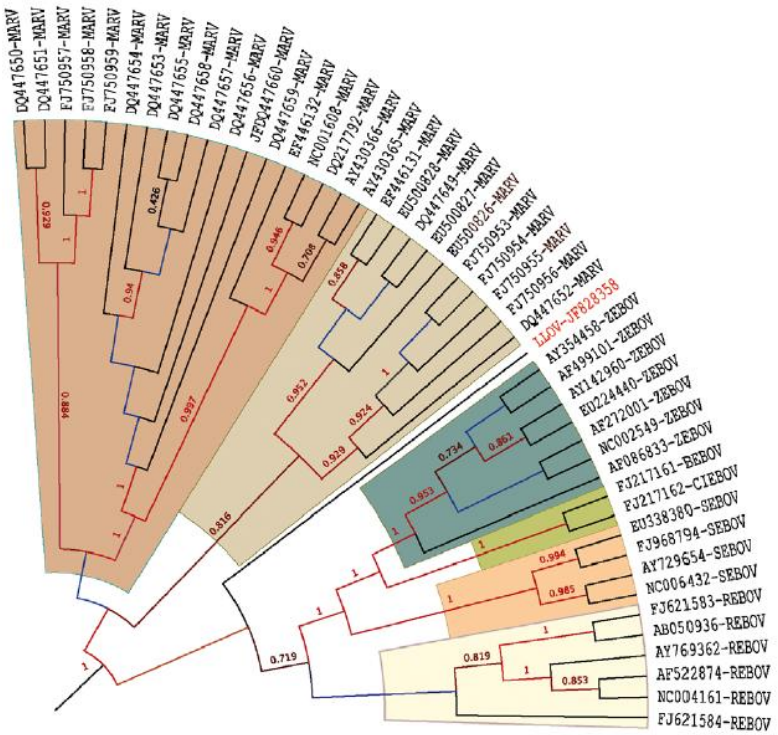
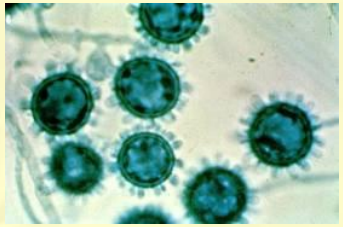
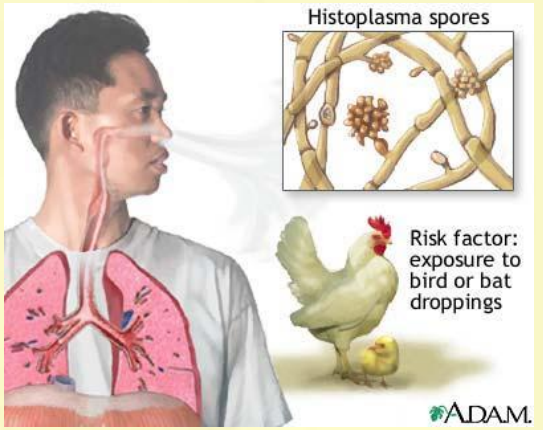


Figure 3. Phylogenetic analysis of LLOV. (A) Analysis of the conserved domain of the RNA-dependent RNA polymerase of *Mononegavirales*. Branch lengths in the unrooted tree are nonsynonymous distances (dN) taken from the subset of the second codon position of the conserved domain III of the polymerase protein (DS1). Bootstrap results (displayed in colors) were computed using 1,000 pseudoreplicates of the original dataset (DS1); **(B) Analysis of the complete genome of *Filoviridae*.** Rooted topology summarizes the historical relationships of 48 complete genome viruses of *Filoviridae*. Values on branches represent clade probabilities (SH). Values lower than 0.5 are not shown. Branch lengths were constrained to show ultrametric distances. Unconstrained distances and the full set of outgroup species are shown in **Figure S5**.
doi:10.1371/journal.ppat.1002304.g003

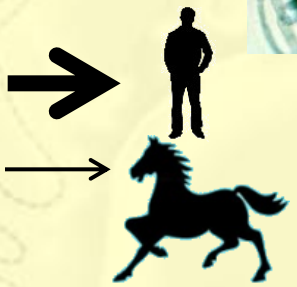
Patógenos Zoonóticos en Murciélagos

Histoplasmosis *(Histoplasma capsulatum)*

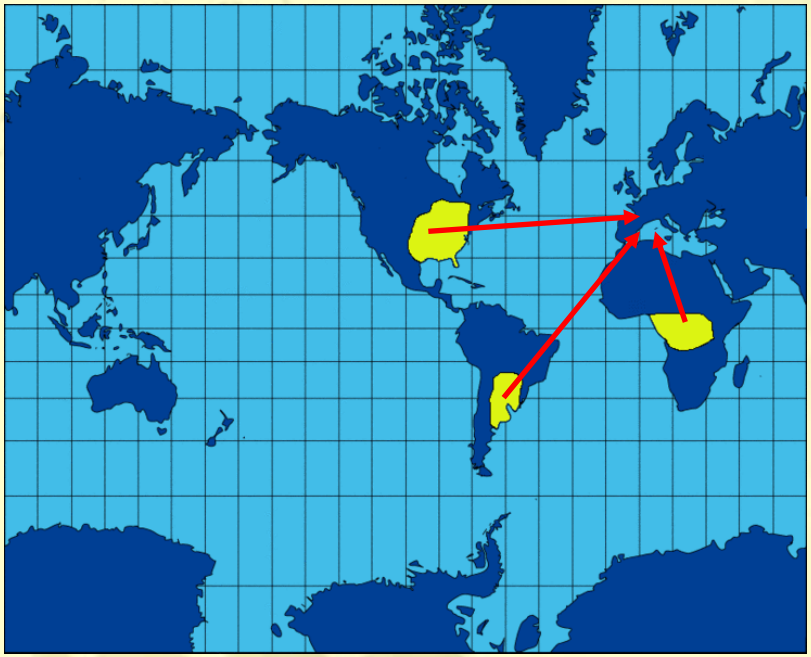




H. capsulatum var. *capsulatum*
H. capsulatum var. *duboisii*
H. capsulatum var. *farciminosum*



Áreas endémicas



Imported Histoplasmosis in Spain

J. Gascón, J.M. Torres, P. Luburich, J.R. Ayuso, A. Xaubet, and M. Corachán

J Travel Med 2000; 7:89–91.

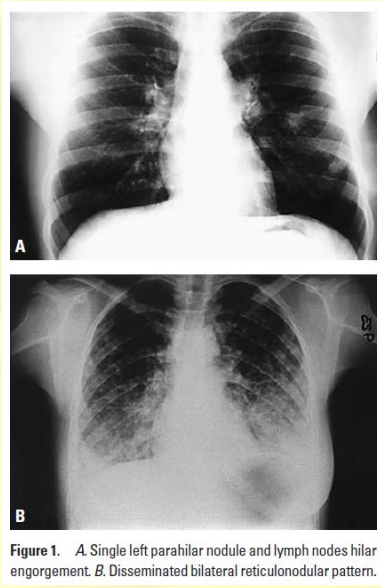


Figure 1. *A.* Single left parahilar nodule and lymph nodes hilar engorgement. *B.* Disseminated bilateral reticulonodular pattern.

Clínica

Fiebre, escalofríos, dolor cabeza, dolor muscular, dyspnea
Tuberculosis-like neumonía

Transmisión

Vía respiratoria – Esporas en guano murciélagos y aves

Patógenos no Zoonóticos en Murciélagos

Síndrome de la nariz blanca *(Geomyces destructans)*

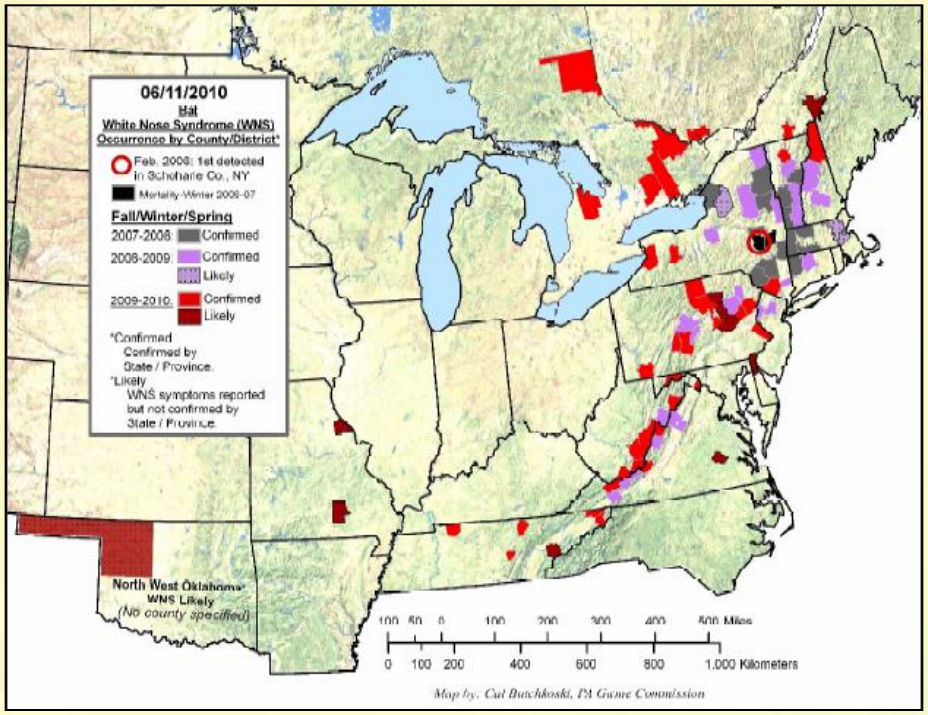
2006 – Mortalidad masiva (cientos de miles) de murciélagos en EEUUAA y Canadá
Mayor mortalidad en especies hibernantes en cuevas

Clínica

Pérdida de peso, emaciación, desorientación, caída de la percha

G. destructans provoca alteraciones en los periodos de hibernación, forzando actividad en periodos con escasez de alimento, asociado a las lesiones.

Myotis lucifugus



White-Nose Syndrome Fungus (*Geomyces destructans*) in Bat, France

Sébastien J. Puechmaille, Pascal Verdeyroux, Hubert Fuller, Meriadeg Ar Gouilh, Michaël Bekaert, and Emma C. Teeling

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 16, No. 2, February 2010

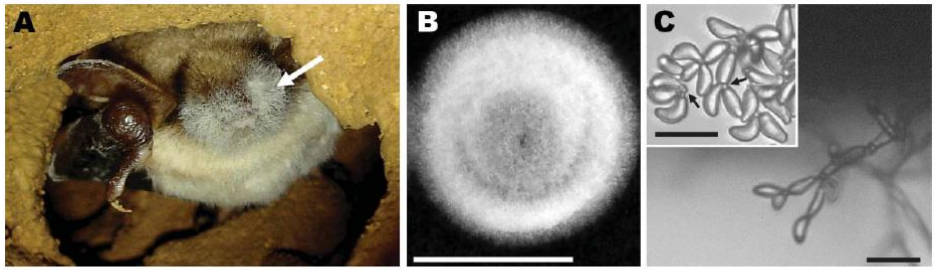


Figure 1. A) *Myotis myotis* bat found in a cave on March 12, 2009, in France, showing white fungal growth on its nose (arrow). B) Fungus colony on malt extract medium after incubation for 3 weeks at 10°C. Scale bar = 1 cm. C) Clusters of unstained spores of *Geomyces destructans*. Spores in the inset were stained with lactophenol cotton blue, which shows the truncate spore base (arrows) and surface granulation. Scale bars = 10 µm.

Patógenos Zoonóticos en Murciélagos

Riesgos para Salud Pública y Sanidad Animal

Table 6. Examples of incubation periods and times to death relating to human mortalities from bat-associated lyssavirus exposure.

[See appendix E for more detailed descriptions of the nine cases below]

Case[1]	Exposure location	Day of onset of symptoms after exposure	Day of death following onset of symptons	Comments
1	South America	27 days	9	Victim bitten on toe while sleeping; bat seen flying from foot when victim awoke.
2	North America	16 days	9	Victim bitten on forearm when bat picked up from ground.
3	North America	About 6 weeks	4	Airborne exposure in cave occupied by millions of bats.
4	North America	26 days	12	Victim bitten on finger when bat was rescued from attack by dogs; dogs potentially exposed.
5	North America	21 days	7	Victim bitten on ear while sleeping; bite awoke victim, cat ate bat; cat potentially exposed.
6	Europe	51 days	11	Victim bitten by abnormally acting bat that was then released.
7	Africa	About 1 month	4	Victim awakened by bat bite on lip.
8	India	About 11 weeks	[2] 5	Victim bitten on forearm when bat was picked up from ground.
9	Australia	Unknown	16	Victim cared for fruit bats.

[1] Case 1, Hurst and Pawan, 1932; Case 2, Sulkin and Greve, 1954; Case 3, Irons and others., 1957; Case 4, Humphrey and others, 1960; Case 5, Humphrey and others, 1960; Case 6, Lumio and others, 1986; Case 7, Meredith and others, 1971; Case 8, Veeraraghavan, 1955; Case 9, Allworth and others, 1996.

[2] May be longer, because the day of the onset of symptoms was not recorded.

Patógenos Zoonóticos en Murciélagos

Riesgos para Salud Pública y Sanidad Animal

CDC investigators collecting *Rousettus aegyptiacus* bats in Kitum Cave (western Kenya), during surveillance for emerging zoonotic pathogens

© IVAN KUZMIN, CDC

Patógenos Zoonóticos en Murciélagos

Riesgos para Salud Pública y Sanidad Animal

Table 10. Preemptive actions for minimizing human exposures to lyssaviruses.

Potential source for exposure	Preemptive actions
All bat species	
"Home deliveries" of bats by domestic cats	Vaccinate and confine cats. Control stray and feral cats.
Colonies of bats in manmade structures	
Schools	Prevent bat entry.
Other public contact sites	Prevent bat entry or post warning signs.
Colonies of bats in caves or mine tunnels	Prohibit entry to all but immunized persons with justifiable need for entry.
Flying bats observed entering buildings at night	Avoid contact and promptly facilitate ability of flying bat to exit building. Safely collect and submit non-flying bats for testing.
Unprovoked attacks by day-flying bats	Upon seeing flying bat, remain quiet and motionless until bat departs.
Vampire bats	
Colonies in human-inhabited areas	Destroy colonies using appropriate techniques.
Attacks on people	Educate susceptible human populations about vampire bat rabies and initiate appropriate protective measures, including vaccination and post-exposure treatment programs.
Attacks on livestock	Vaccinate livestock, employ protective husbandry of livestock, and institute vampire bat control programs.
Attacks on dogs and cats	Vaccinate pets, control their outdoor movements, and house pets indoors.
Attacks on other bats	Consider tropical bat bites, and other interactions between vampires and other bat species, as rabies exposures unless quickly proven otherwise.