MALATTIE TRASMESSE DA VETTORI

Calzolari Dr. Mattia

Dottori Dr. Michele

ISTITUTO ZOOPROFILATTICO SPERIMENTALE
DELLA LOMBARDIA E DELL'EMILIA ROMAGNA
SEZIONE DI REGGIO EMILIA
Via Pitagora, 2
42100 REGGIO EMILIA
TEL. (0522) 921733 - (0522) 277996
fax (0522) 518639 - E-mail: ReggioEm@bs.izs.it

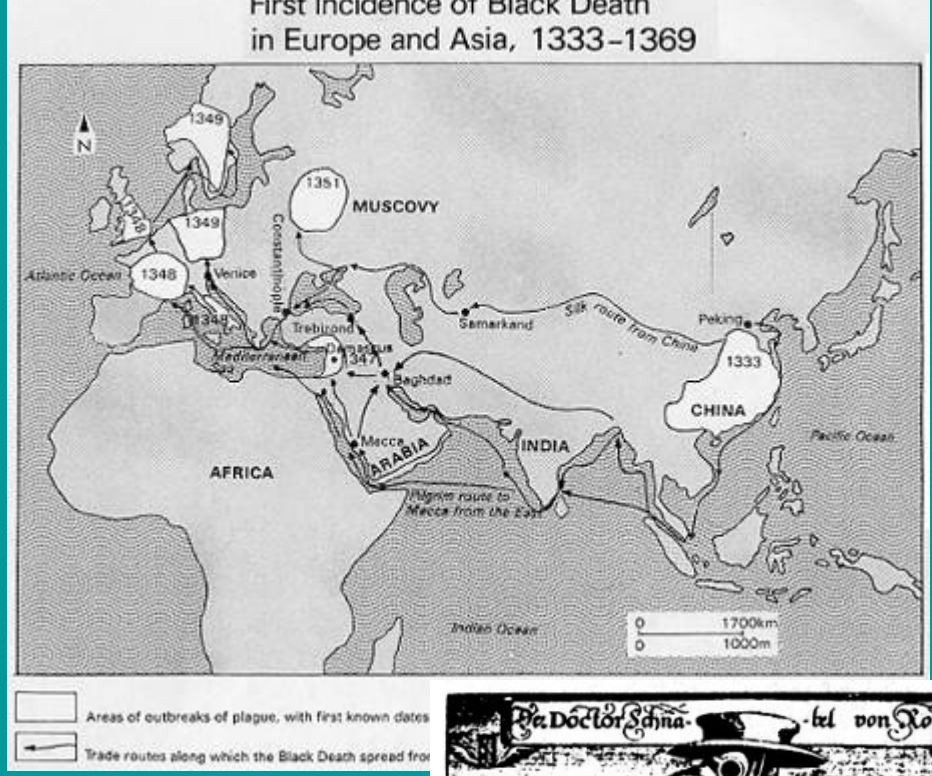
Arthropod Vector	Disease	Disease Agent		Method of Human Exposure
Arachnida				
Mite: *Leptotrombidium sp.* (red mites)	Scrub Typhus (Tsutsugamushi disease)	*Rickettsia tsutsugamushi*	(bacteria, intracellular)	Bite of larval mite
Mite: *Liponyssiodes sanguineus* (mouse mite)	Rickettsial pox	*Rickettsia akari*	(bacteria)	Bite of mite
Tick: *Dermacentor* sp.	Tularemia	*Francisella tularensis*	(Gram negative bacteria)	Bite of tick
Tick: *Dermacentor* sp. and other Ixodid ticks	Rocky Mountain Spotted Fever	*Rickettsia rickettsia*	(bacteria)	Bite of tick
Tick: *Ornithodoros sp.*	Endemic Relapsing Fever	*Borrelia sp.*	(bacteria, spiral shaped)	Bite of tick
Tick: *Ixodes* sp.	Babesiosis	*Babesia microti*	(parasite, protozoan)	Bite of tick
Tick: *Ixodes* sp.	Lyme disease	*Borrelia burgdorferi*	(bacteria, spiral shape)	Bite of tick
Tick: *Dermacentor variabilis, Amyblyomma americanum*	Ehrlichiosis, Sennetsu fever	*Ehrlichia canis, E. sennetsu, E. chaffeensis, E. equi, E. phagocytophilia*	(bacteria, intracellular)	Bite of tick
Tick: *Dermacentor* sp.	Colorado Tick Fever	CTF virus, Eyach virus, or strain S6-14-03	(Reoviridae)	Bite of tick
Tick:	Russian Spring-Summer Encephalitis, Louping Ill Encephalitis, Langat Encephalitis, Powassan Encephalitis, Omsk hemorrhagic fever	Russian Spring-Summer Encephalitis, Louping Ill Encephalitis, Langat virus, Powassan virus, Omsk hemorrhagic fever virus	(Flaviviridae)	Bite of tick
Tick:	Nairobi Sheep fever, Crimean hemorrhagic fever	Nairobi sheep disease virus, Crimean-Congo hemorrhagic fever virus	(Bunyaviridae)	Bite of tick
Crustacea				
Copepod: *Cyclops* sp.	Diphyllobothriasis, fish tapeworm	*Diphyllobothrium latum*	(parasite, cestode, tapeworm)	Arthropod is 1st intermediate host then man swallows infected fish
Copepod: *Cyclops* sp.	Sparganosis	*Diphyllobothrium spirometra*	(parasite, cestode, tapeworm)	Man swallows infected *Cyclops.*
Copepod: *Cyclops* sp.	Dracunculosis	*Dracunculus medinensis*	(parasite, cestode, tapeworm)	Man swallows infected *Cyclops.*
Crabs, crayfish: various freshwater species	Paragonimiasis	*Paragonimus westermani*	(parasite, cestode, tapeworm)	Man eats infected crustacean.

Insecta

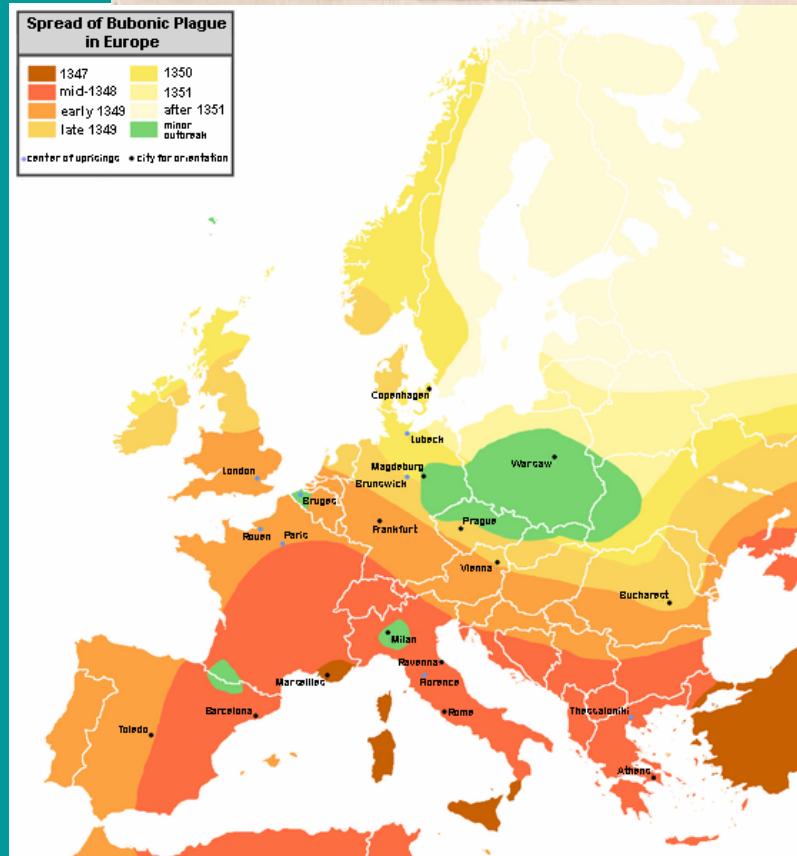
Lice: *Pediculus humanus*	Epidemic typhus	*Rickettsia prowazekii*	(bacteria)	"Bite," contaminated by louse feces or crushing louse on skin
Lice: *Pediculus humanus*	Trench fever, bacillary angiomatosis, bacillary peliosis	*Bartonella quintana*	(Gram negative bacteria)	"Bite," contaminated by louse feces or crushing louse on skin
Lice: *Pediculus humanus*	Louse-borne relapsing fever or epidemic relapsing fever	*Borrelia recurrentis*	(bacteria; spiral shape)	"Bite," contaminated by louse feces or crushing louse on skin
Flea: *Xenopsylla cheopis* , and various other rodent fleas	Plague	*Yersina pestis*	(Gram negative rod shaped bacteria)	"Bite" and feces of flea
Flea: *Xenopsylla cheopis*	Murine typhus	*Rickettsia typhi*	(bacteria)	"Bite" and feces of flea
Flea: *Xenopsylla cheopis* , and various other rodent fleas	Rat tapeworm infection	*Hymenolepsis diminuta*	(parasite; cestode; tapeworm)	Swallowing infected flea
Flea: various species	Dog tapeworm infection, Dipylidiasis	*Diphylidium caninum*	(parasite; cestode; tapeworm)	Swallowing infected flea
Bug: *Triatoma* species, *Panstrongylus* sps (Kissing assassin bug, Reduvid bug)	Chaga's disease	*Trypanosoma cruzi*	(parasite; protozoan)	Rubbing infected feces on mucous membranes or skin
Beetles: flour beetle	Hymenolepsis	*Hymenolepsis nana*	(parasite; tapeworm; cestode)	Swallowing infected beetle
Fly, gnat: *Glossina* sp. (tsetse fly)	African trypanosomiasis, African sleeping sickness	*Trypanosoma brucei rhodesiense and T.b. gambiense*		Bite of infected fly
Fly, gnat: *Simulium* sp. (black fly)	Onchocerciasis, River blindness	*Onchocerca volvulus*	(parasite; round worm; nematode)	Bite of infected fly
Fly, gnat: *Chrysops* sp.	Tularemia	*Francisella tularensis*		Bite of infected fly
Fly, gnat: *Phlebotomus* sp., *Lutzomyia* sp. (sandflies)	Leishmaniasis	*Leishmania* donovani (Visceral, dumdum fever, kala-azar), *L. tropica* (cutaneous; oriental sore, Delphi boil), *L. braziliensis* (mucocutaneous; espundia, american leishmaniasis, chiclero ulcer)	(parasite; protozoan)	Bite of infected fly
Fly, gnat: *Phlebotomus* sp. (sandfly in Peru, Ecuador and Columbia)	Bartonellosis, Oroya fever, Carrion's disease	*Bartonella bacilliformis*	(Gram negative bacteria)	Bite of infected fly
Fly, gnat: *Chrysops* sp. (mango flies)	Loaiasis, Eye worm	*Loa loa*	(parasite; nematode; roundworm)	Bite of infected fly
Fly, gnat: sandfly	Sandfly fever, Rift Valley fever	Sandfly fever Naples virus, Sandfly fever Sicilian virus, Rift valley fever virus	(Bunyaviridae)	Bite of infected fly

Mosquito: *Anopheles* sp.	Malaria	*Plasmodium falciparum, P. malariae, P. vivax, P. ovale*	(parasite; protozoan)	Bite of infected mosquito
Mosquito: various species	Bancroftian filariasis, filarial Elephantiasis	*Wuchereria bancrofti*	(parasite; nematode; roundworm)	Bite of infected mosquito
Mosquito: various species	Malayan filariasis, filarial Elephantiasis	*Brugia malayi*	(parasite; nematode; roundworm)	Bite of infected mosquito
Mosquito: various species	Dirofilariasis	*Dirofilaria immitis*		Bite of infected mosquito
Mosquito: *Aedes aegypti*	Yellow fever	Yellow fever virus	(Flaviviridae)	Bite of infected mosquito
Mosquito: *Aedes* sp.	Dengue fever, Break Bone fever	Dengue fever virus	(Flaviviridae)	Bite of infected mosquito
Mosquito: *Culiseta melanura, Coquillettidia pertubans, Aedes vexans*	Eastern Equine encephalitis	Eastern Equine Encephalitis virus	(Togaviridae)	Bite of infected mosquito
Mosquito: *Aedes triseriatus*	La Crosse encephalitis	La Crosse Encephalitis virus	(Bunyaviridae)	Bite of infected mosquito
Mosquito: *Culex* sp.	St. Louis encephalitis	St. Louis Encephalitis virus	(Flaviviridae)	Bite of infected mosquito
Mosquito: *Culex* sp., *Culex tarsalis*	Venezualan equine encephalitis, Western equine encephalitis	Venezualan Equine Encephalitis virus, Western Equine Enchephalitis virus	(Togaviridae)	Bite of infected mosquito
Mosquito: *Culex* sp.	Ockelbo disease	Sindbis virus	(Togaviridae)	
Mosquito	Chikungunya forest fever	Chikungunya virus, Mayaro fever, Mucambo fever, O'Nyong-Nyong fever, Pixuna fever, Ross River fever	(Togaviridae)	"
Mosquito	fevers and encephalitis	Nile fever, Japanese encephalitis virus, West Nile fever, Zika fever, Wesselsbron fever, Kyasanur forest disease virus	(Flaviviridae)	"
Mosquito	fevers and encephalitis	Oropouche virus, Bunyamwera, Bwamba fever, Guama fever, Oropouche fever, California Enchephalitis virus	(Bunyaviridae)	"
Mosquito	fevers	Chandipura fever, Piry fever	(Rhabdoviridae)	"

modivicato da http://www.kcom.edu/faculty/chamberlain/arthro.htm


First incidence of Black Death
in Europe and Asia, 1333–1369
N
1349
1351
MUSCOVY
1348
Venice
Constantinople
Trebizond
Damascus
1347
Baghdad
Samarkand
Silk route from China
Peking
1333
CHINA
INDIA
Mecca
ARABIA
AFRICA
Pilgrim route to Mecca from the East
Atlantic Ocean
Mediterranean Sea
Pacific Ocean
Indian Ocean
0 1700km
0 1000m
Areas of outbreaks of plague, with first known dates
Trade routes along which the Black Death spread fro


Die Doctor Schna- -bel von Rom

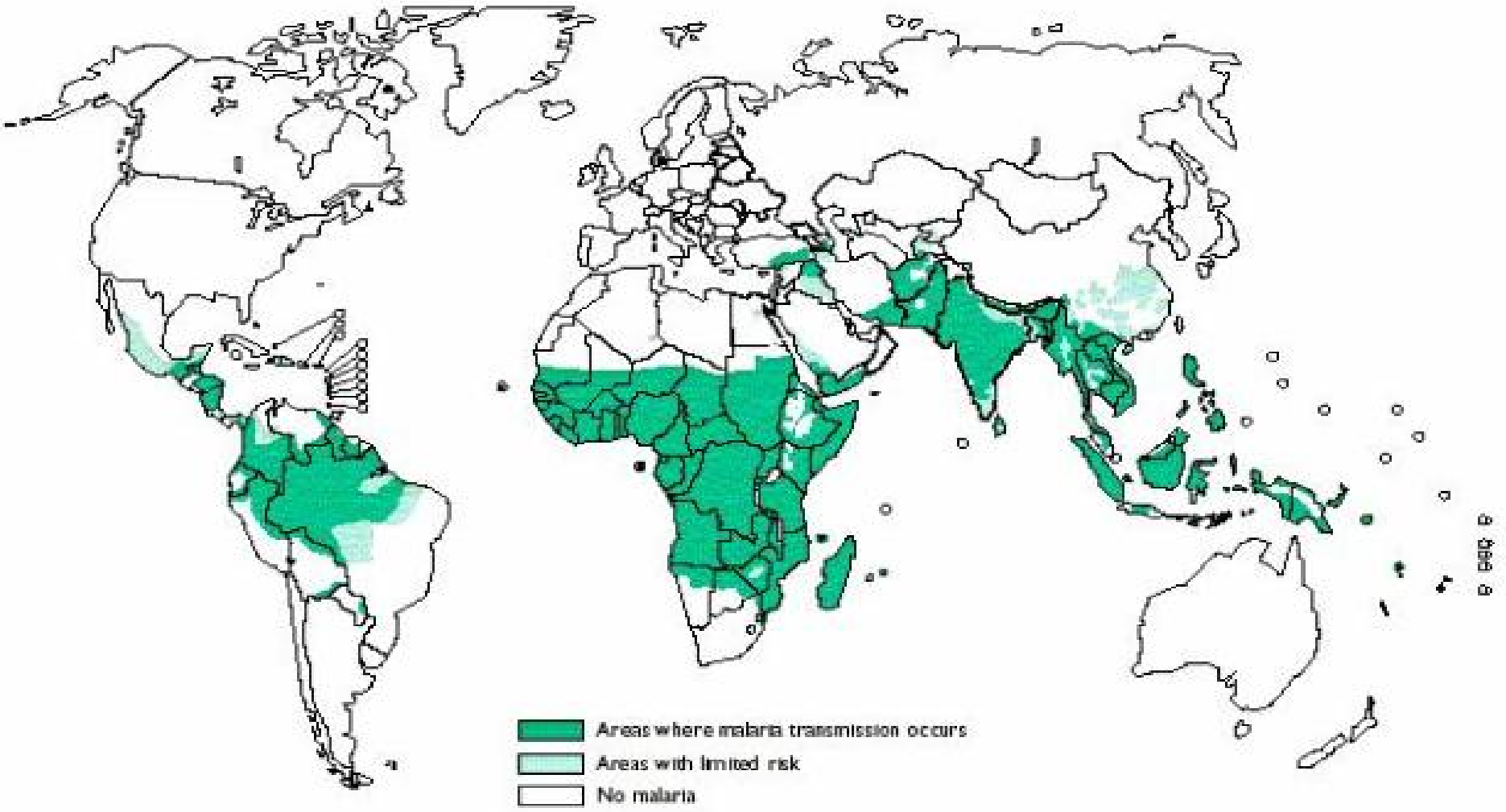

Spread of Bubonic Plague in Europe
1347
mid-1348
early 1349
late 1349
1350
1351
after 1351
minor outbreak
center of uprisings
city for orientation
Copenhagen
Lubeck
London
Magdeburg
Brunswick
Warsaw
Bruges
Prague
Rouen
Paris
Frankfurt
Vienna
Bucharest
Milan
Ravenna
Marseilles
Florence
Barcelona
Rome
Thessaloniki
Toledo
Athens

Alcuni agenti patogeni trasmessi da zanzare

TABLE 9.2 Some Disease Agents Transmitted by Mosquitoes

Disease agent and disease	Hosts		Important vectors
	Natural	Tangential	
Virus			
eastern equine encephalitis	Bird	Human	*Coquilletidia perturbans*
Venezuelan encephalomyelitis	Small mammal	Human, horse	*Cx. pipiens*, etc.
Western equine encephalomyelitis	Bird	Human, horse	*Cx. tarsalis*
Dengue	Human		*Ae. aegypti, Ae. albopictus*
Japanese encephalitis	Swine	Human	*Cx. tritaeniorhynchus*
St. Louis encephalitis	Bird	Human	*Cx. pipiens, Cx. nigripalpus*
Yellow fever	Primate	Human	*Ae. aegypti, Ae. africanus*
La Crosse encephalitis	Rodent	Human	*Ae. triseriatus*
Apicomplexa			
Malaria	Human		*Anopheles* spp.
Malaria	Bird		*Culex* spp.
Filarioid Nematode			
Wuchereria bancrofti	Human		*Culex, Mansonia*
Brugia malayi	Cat	Human	*Culex, Mansonia*
Dirofilaria immitis	Canid	Human	*Culex, Aedes* spp.

Malaria, 2004



This map is a visual aid only. It is not a definitive source of information about malaria endemicity

Source: WHO, 2004

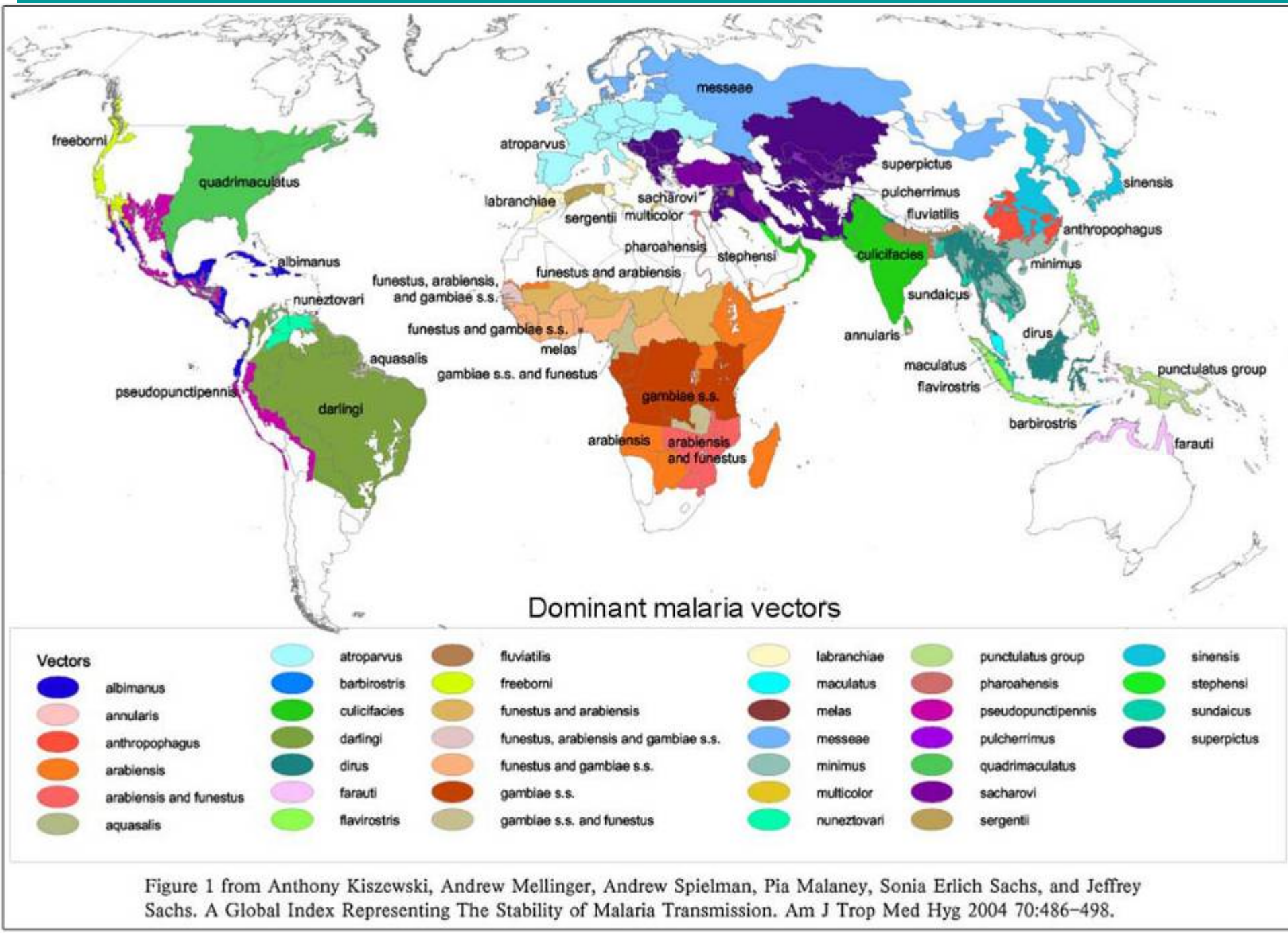


Figure 1 from Anthony Kiszewski, Andrew Mellinger, Andrew Spielman, Pia Malaney, Sonia Erlich Sachs, and Jeffrey Sachs. A Global Index Representing The Stability of Malaria Transmission. Am J Trop Med Hyg 2004 70:486–498.

MOLTI GENERI E SPECIE DI ZANZARE

ZANZARE AUTOCTONE ED INTRODOTTE

ADATTABILITÀ DEGLI ARBOVIRUS AI VETTORI BIOLOGICI ED AI SERBATOI

Culicidi d'Italia

ANOPHELES
algeriensis
atroparvus
claviger
hyrcanus
atroparvus
labranchiae
maculipennis
melanoon
messeae
sacharovi
marteri
petragnani
plumbeus
hispaniola
sergentii
superpictus

CULEX
brumpti
laticinctus
mimeticus
modestus
pipiens
theileri
torrentium
univittatus
hortensis
impudicus
martinii
territans

AEDES
cinereus
geminus
vexans
vittatus
echinus
geniculatus
refiki
albopictus

OCHLEROTATUS
annulipes
berlandi
cantans
caspius
cataphylla
communis
detritus
dorsalis
mariae
pulchritarsis
pullatus
punctor
rusticus
surcoufi
sticticus
zammitii

COQUILLETTIDIA
buxtoni
richiardii

ORTHOPODOMYIA
pulcripalpis

URANOTAENIA
Unguiculata

CULISETA
annulata
subochrea
longiareolata
fumipennis
litorea
morsitans

Alcuni Aedini Italiani

Ochlerotatus caspius

Ochlerotatus cantans

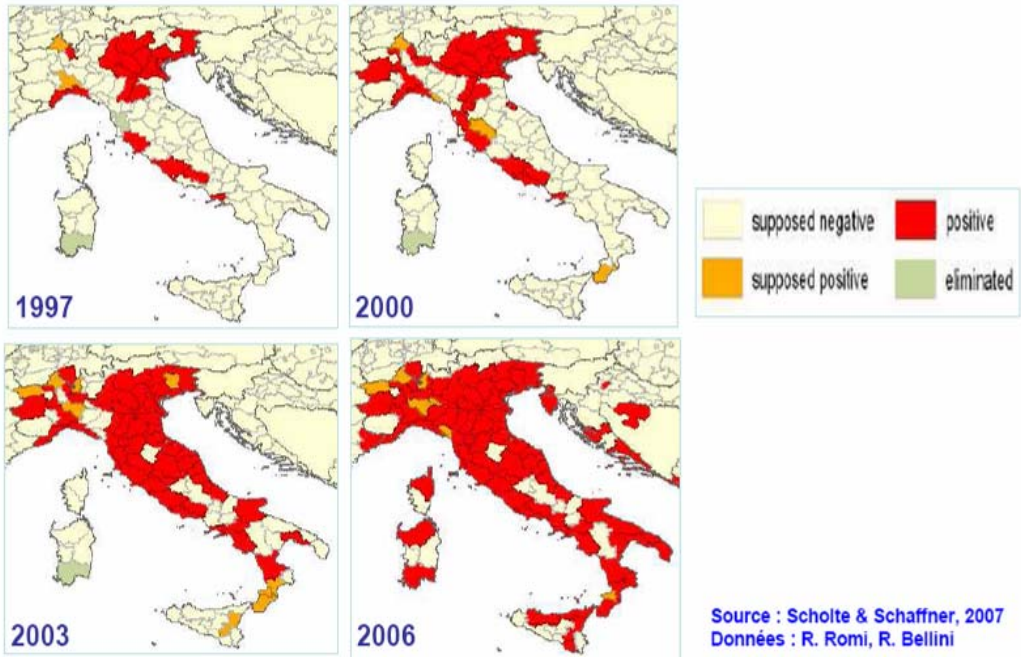
Ochlerotatus detritus

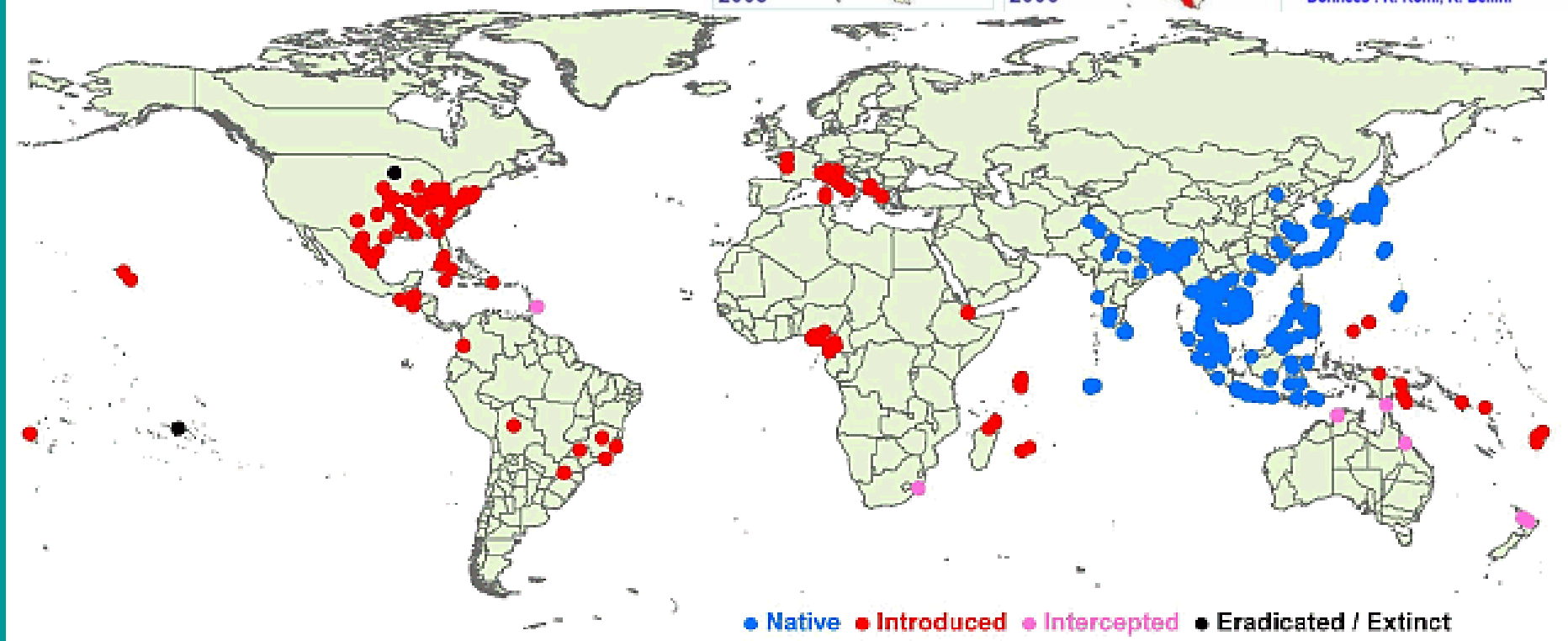
Aedes vexans

Aedes cinereus

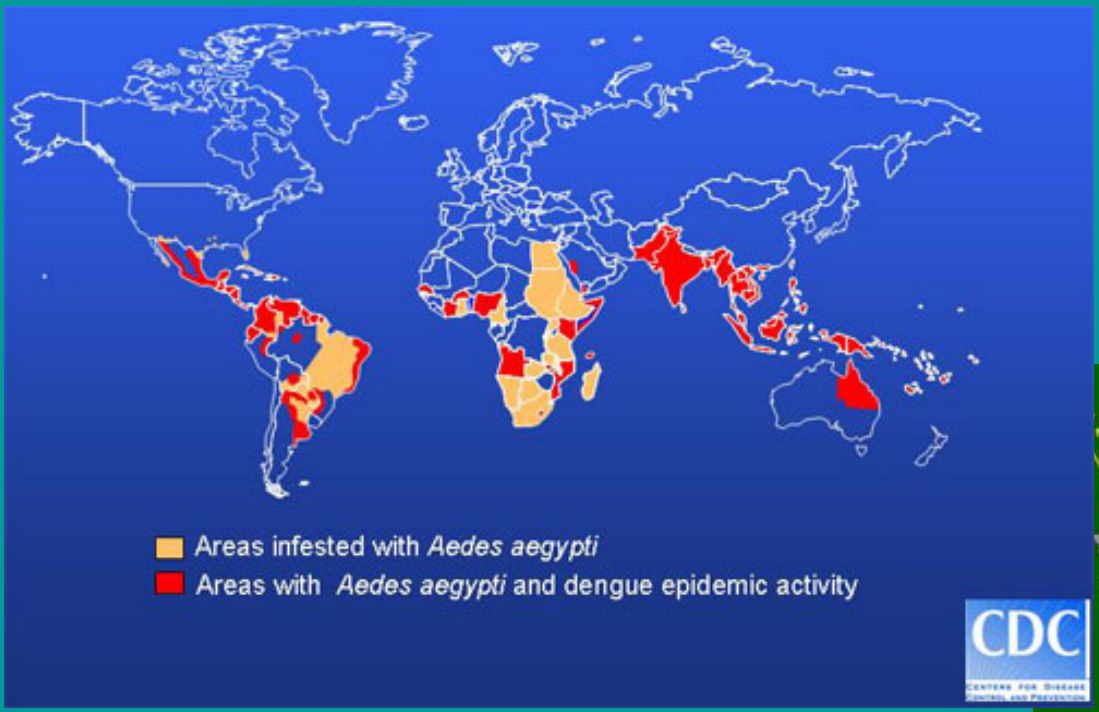
Orthopodomyia pulcripalpis

Zanzara tigre





Aedes aegypti



Da Romi ISS

CICLI

SILVESTRI

RURALI

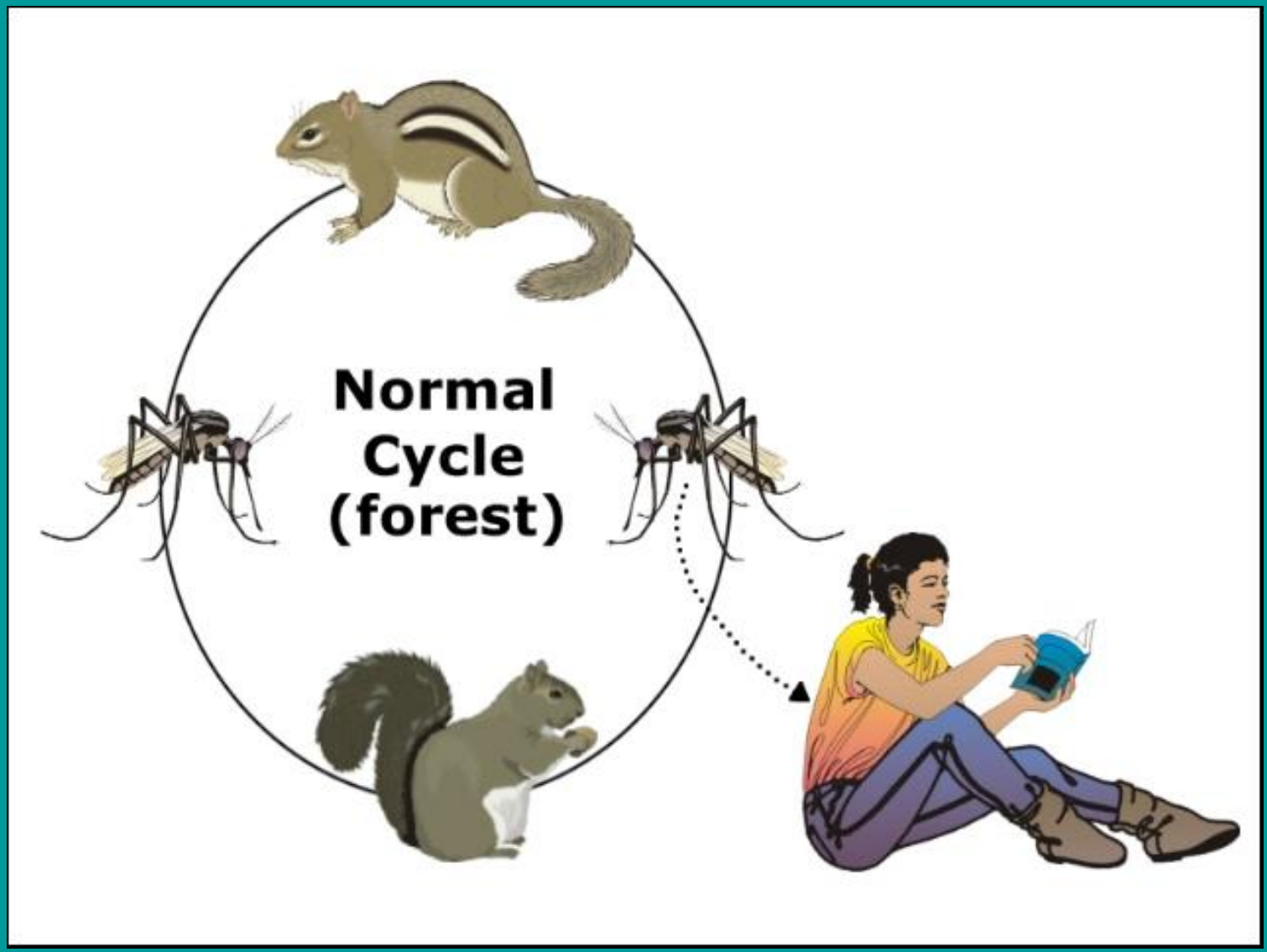
URBANI

ANIMALE / ZANZARA / UOMO

UOMO / ZANZARA / UOMO

DEN YF CHIK

Encefalite LaCrosse



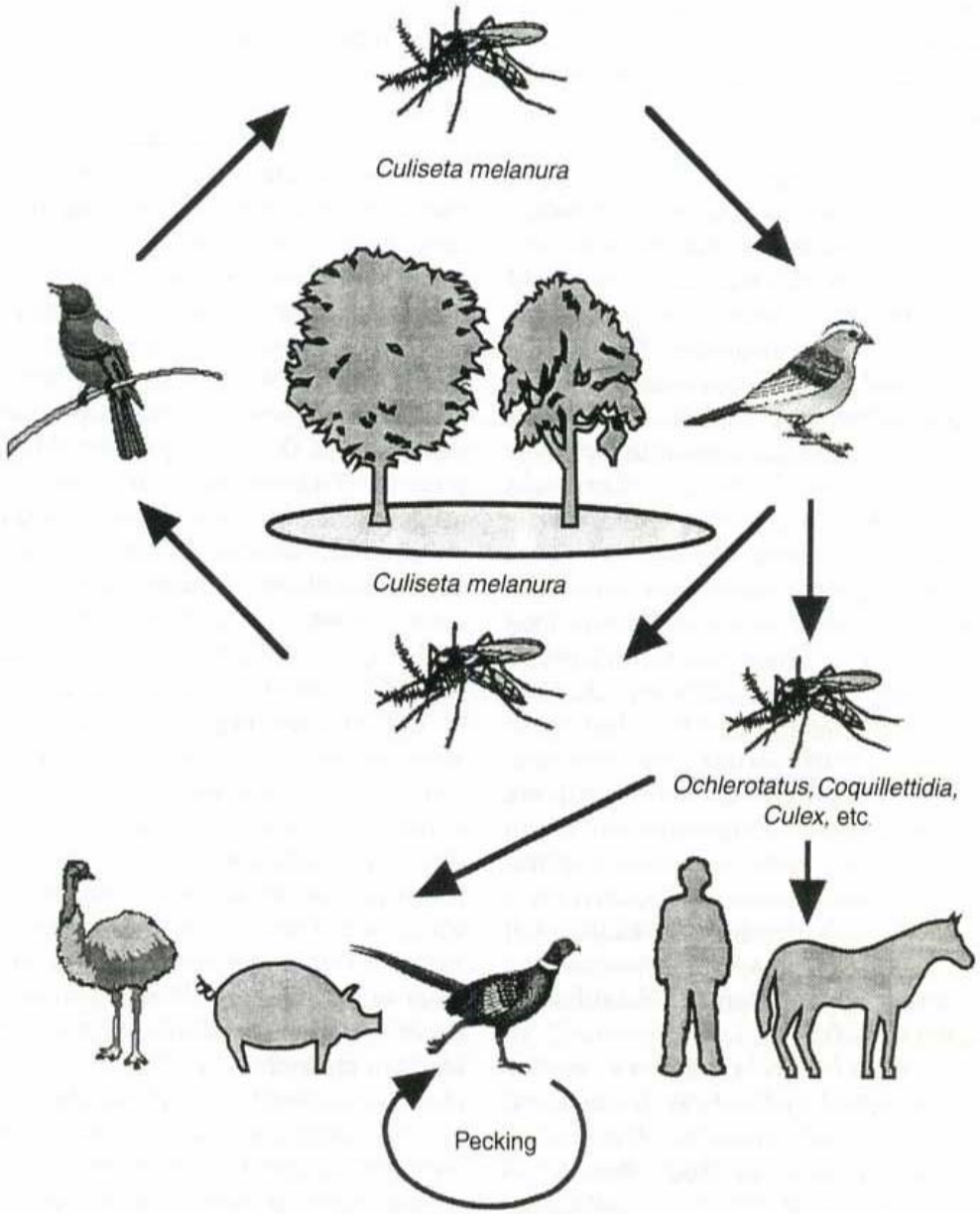
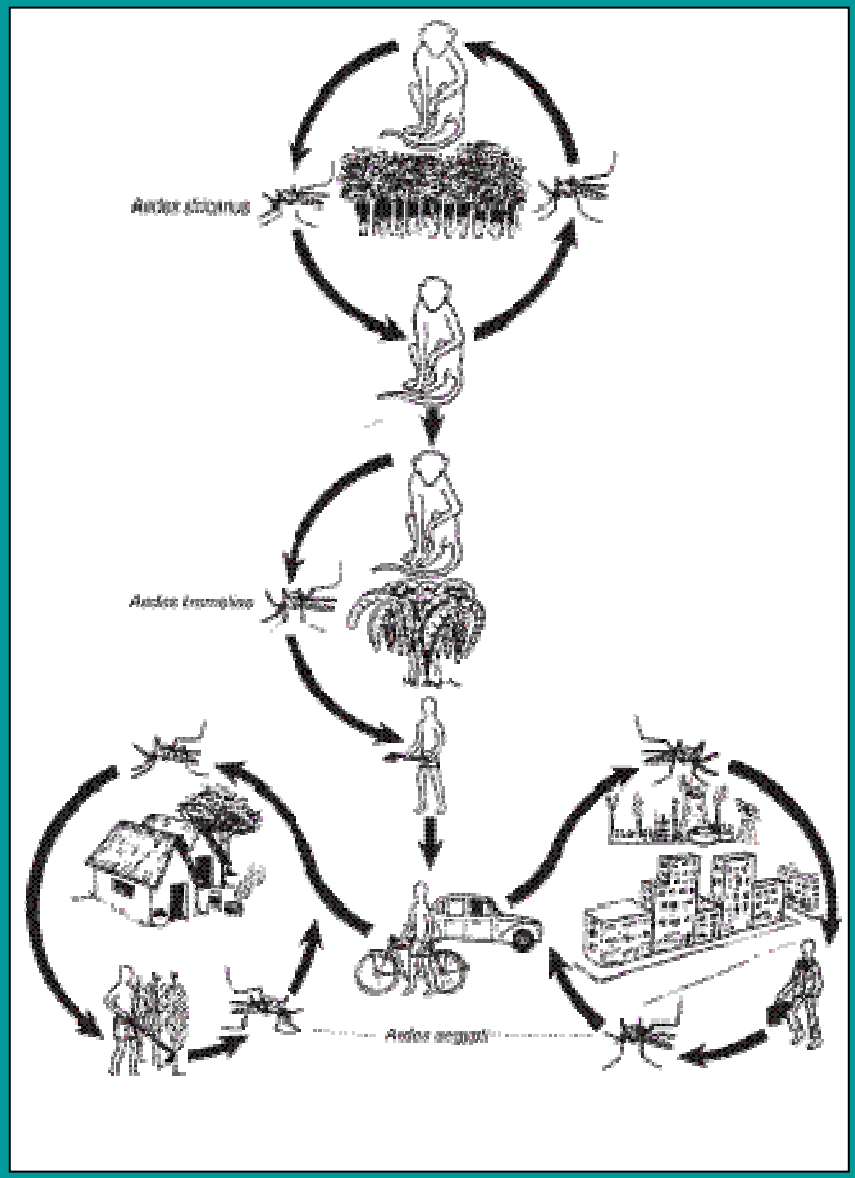


Fig. 4. Cartoon representing the enzootic and epizootic/epidemic EEE virus transmission cycles.

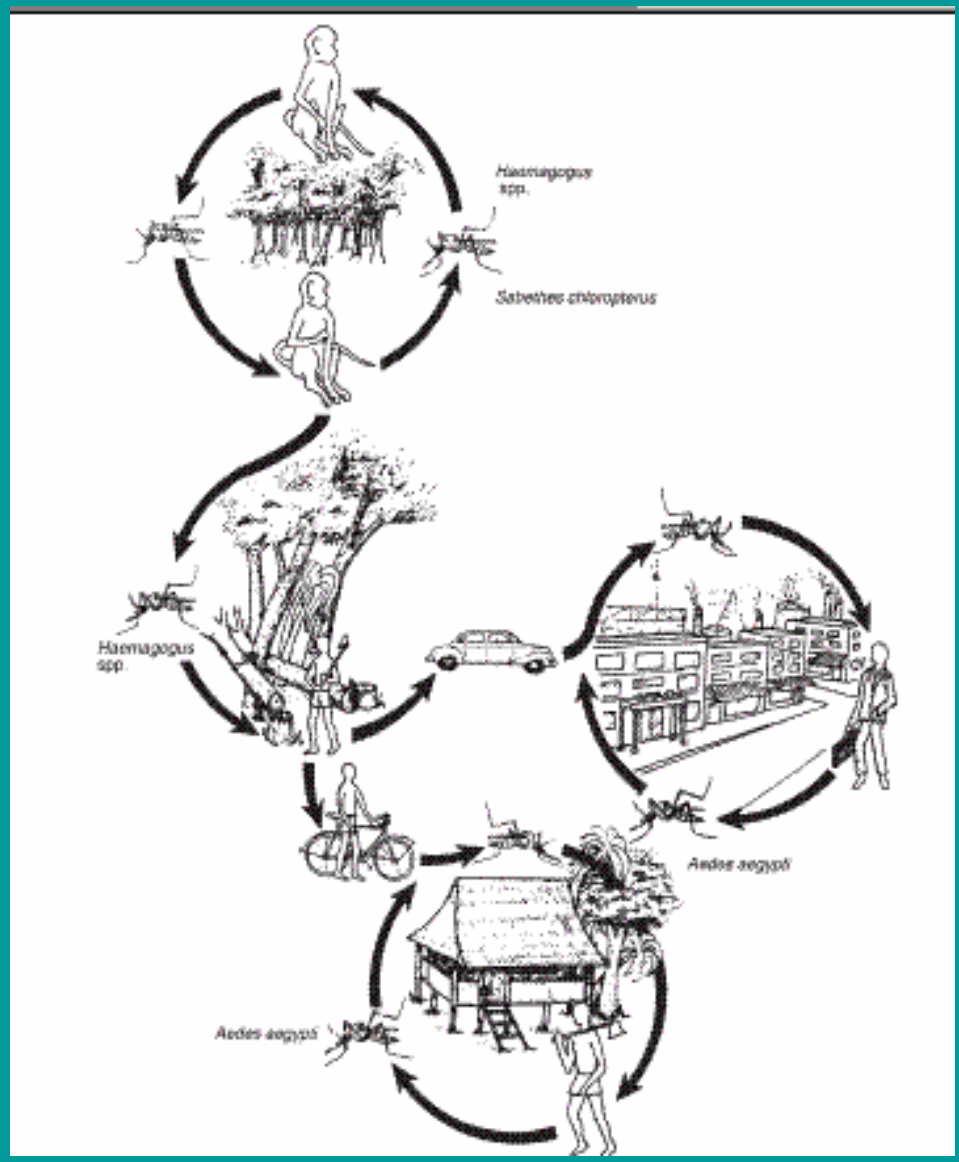
S. C. Weaver

Jungle, rural and urban transmission cycles of yellow fever

Africa



Central and South America



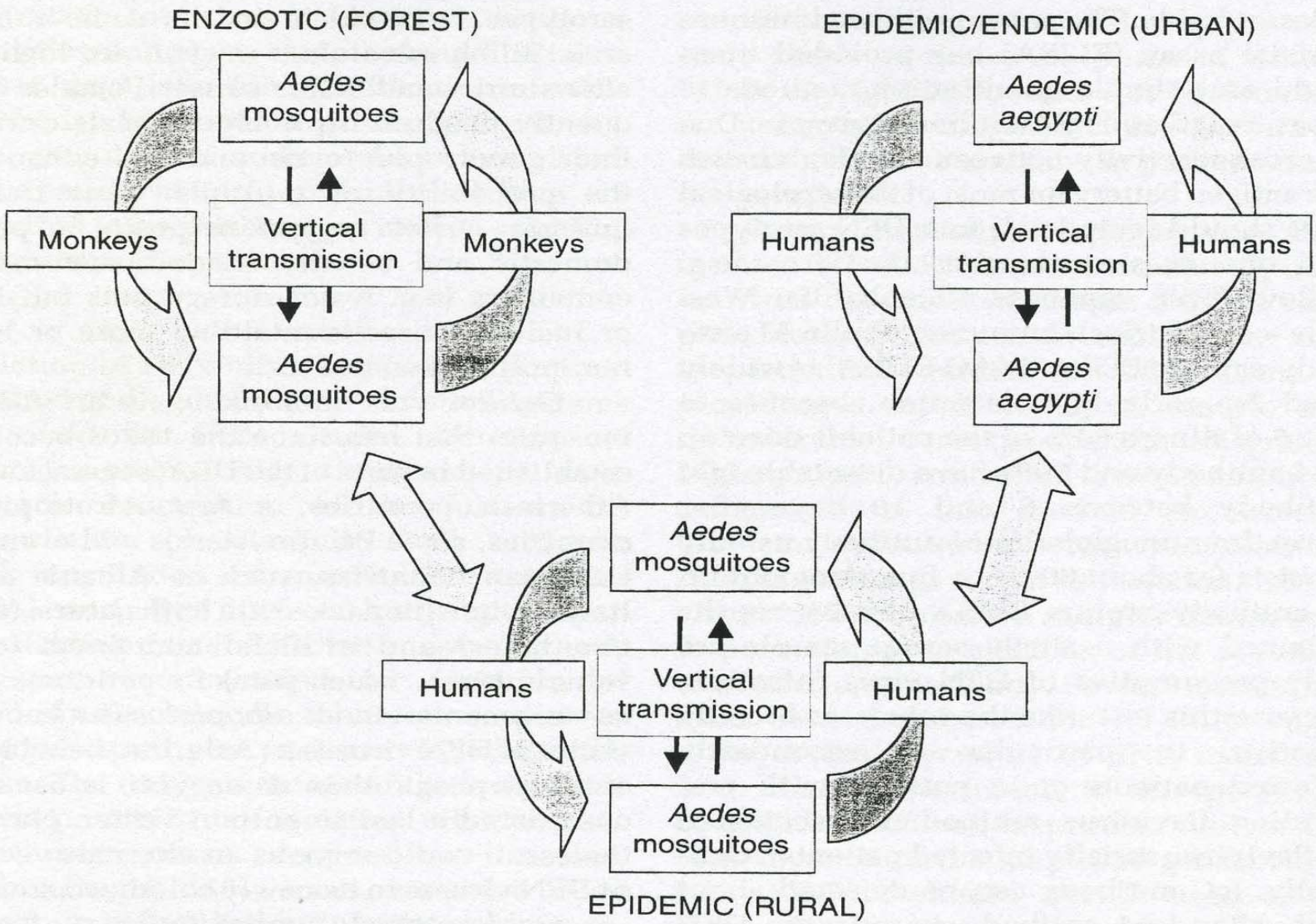
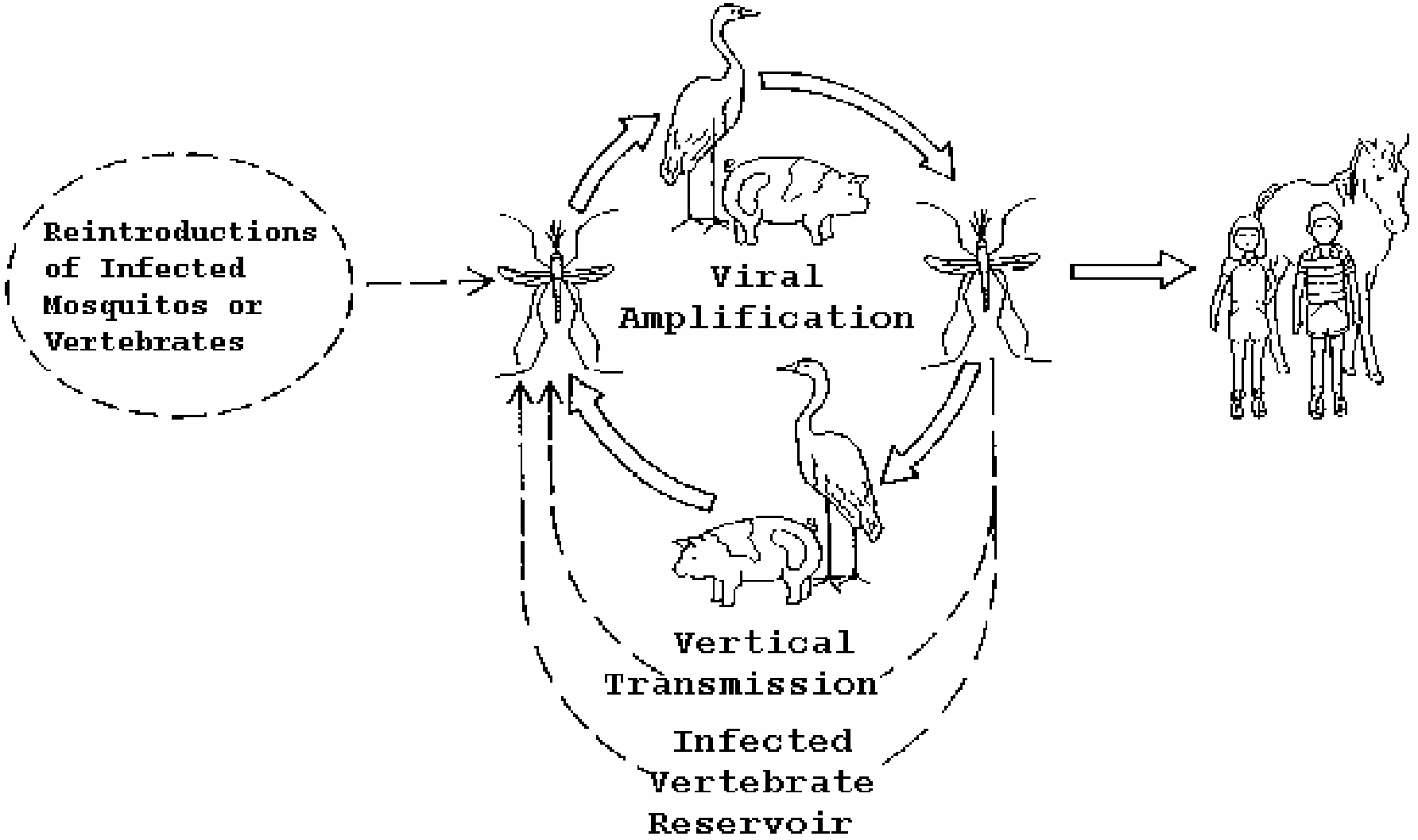


Fig. 4. Natural cycles of dengue transmission.

V. Deubel e B. Murgue

Figure 2. Transmission Cycle of Japanese Encephalitis Virus



SERBATOIO

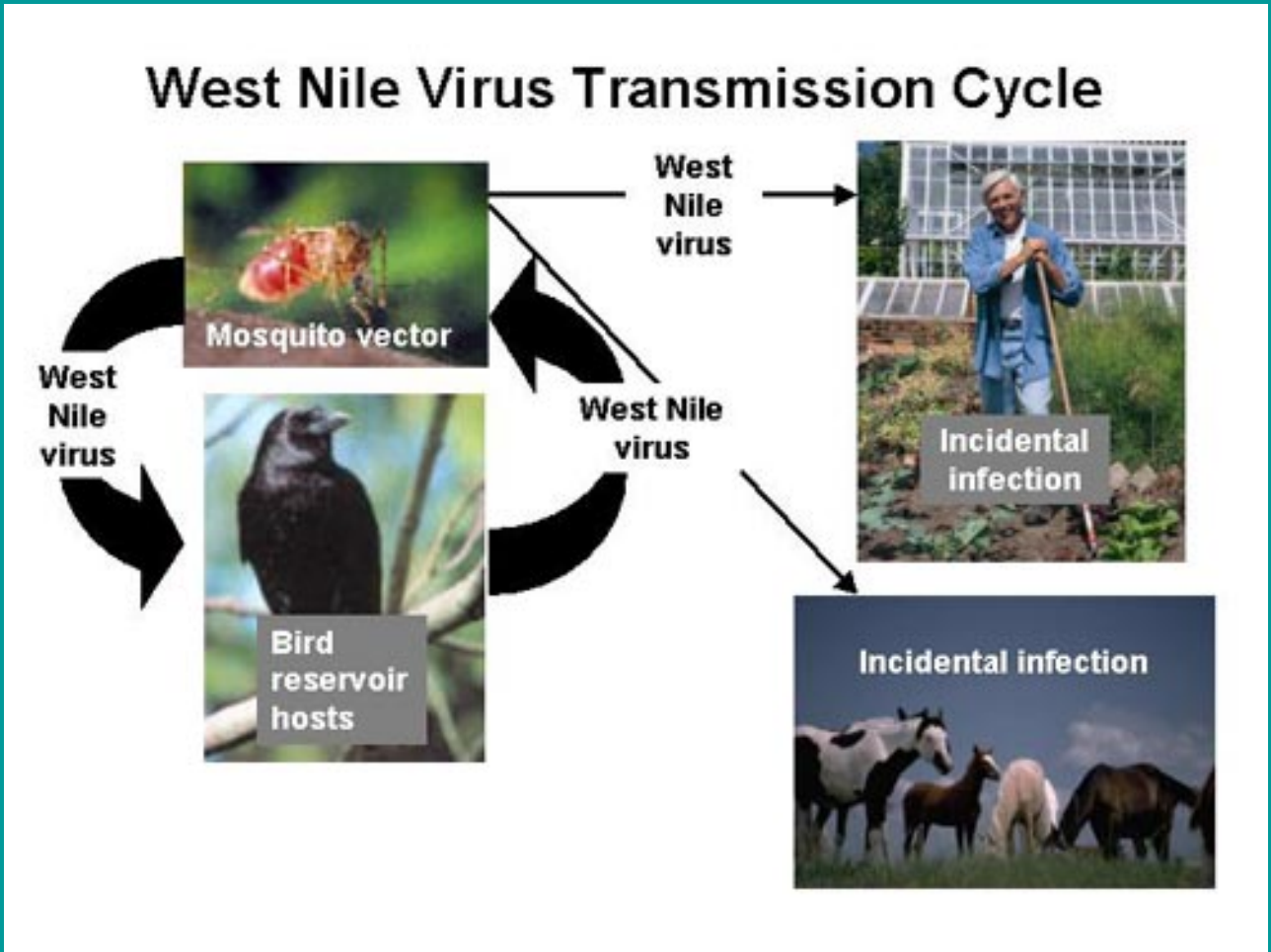
UCCELLI

MAMMIFERI (RODITORI, PIPISTRELLI, ECC.)

RETTILI ED ANFIBI

PRIMATI (HOMO SAPIENS E SCIMMIE)

West Nile Virus Transmission Cycle www.cdc.gov



Isolates of West Nile virus from hematophagous arthropods (1999)

http://www.cdc.gov/ncidod/EID/vol5no5/hubalek.htm#Table%201

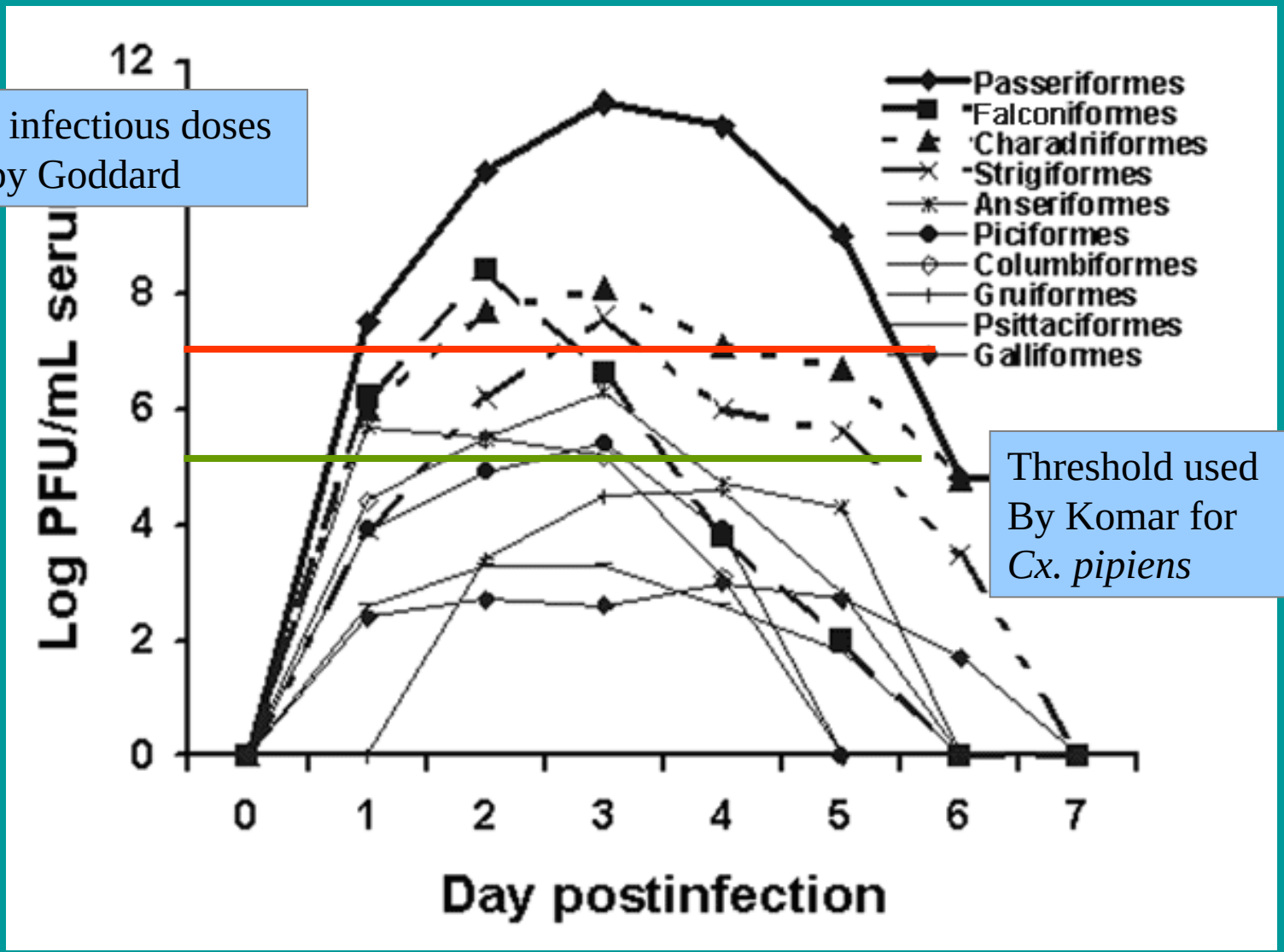
Mosquitoes species	N°	Paesi
Culex antennatus[a]	6	Egypt, Madagascar
decens group	8	Madagascar
ethiopicus	1	Ethiopia
guiarti	1	Côte d Ivoire
modestus	3	France, Russia
neavei	4	Senegal, South Africa
nigripes	1	Central African Republic
perexiguus	1	Israel
perfuscus group	3	Central African Republic, Senegal
pipiens[a]	7	South Africa, Egypt, Israel, Romania, Czechland, Bulgaria[b]
poicilipes	29	Senegal
pruina	1	Central African Republic
quinquefasciatus[a]	7	India, Pakistan, Madagascar
scottii	1	Madagascar
theileri[a]	4	South Africa
tritaeniorhynchus[a]	3	Pakistan, India, Madagascar
univittatus[a]	51	Egypt, Israel, South Africa, Madagascar
vishnui[a] group	6	India, Pakistan
weschei	1	Central African Republic
sp.	3	Egypt, Algeria, Cent. African Rep.
Coquillettidia metallica	1	Uganda
microannulata	1	South Africa
richiardii	5	South Russia, Bulgaria[b]
Mansonia uniformis	1	Ethiopia
Aedes aegypti[a]	1	Madagascar
africanus	1	Central African Republic
albocephalus	35	Madagascar

Mosquitoes species	N°	Paesi
Aedes albothorax	1	Kenya
cantans	7	Slovakia, Ukraine, Bulgaria[b]
caspius[a]	1	Ukraine
circumluteolus	2	South Africa, Madagascar
excrucians	1	Ukraine
juppi+caballus	1	South Africa
madagascarensis	1	Madagascar
vexans	3	Senegal, Russia
Anopheles brunnipes	1	Madagascar
coustani	1	Israel
maculipalpis	1	Madagascar
maculipennis	3	Portugal, Ukraine
subpictus	1	India
sp.	1	Madagascar
Mimomyia hispida	8	Senegal
lacustris	4	Senegal
splendens	6	Senegal
sp.	2	Senegal
Aedeomyia africana	1	Senegal
Soft ticks species		
Argas hermanni[a]	3	Egypt
Ornithodoros capensis[a]	5	Azerbaijan
Hard ticks species		
Hyalomma marginatum	5	Astrakhan, Azerbaijan
detritum	1	Turkmenistan
Rhipicephalus turanicus	1	Azerbaijan
muhsamae	1	Central African Republic
Amblyomma variegatum	1	Central African Republic
Dermacentor marginatus[a]	1	Moldavia

Avian Viremia Response

Komar et al. 2000 EID 9:3

WNV infectious doses used by Goddard



Threshold used By Komar for *Cx. pipiens*

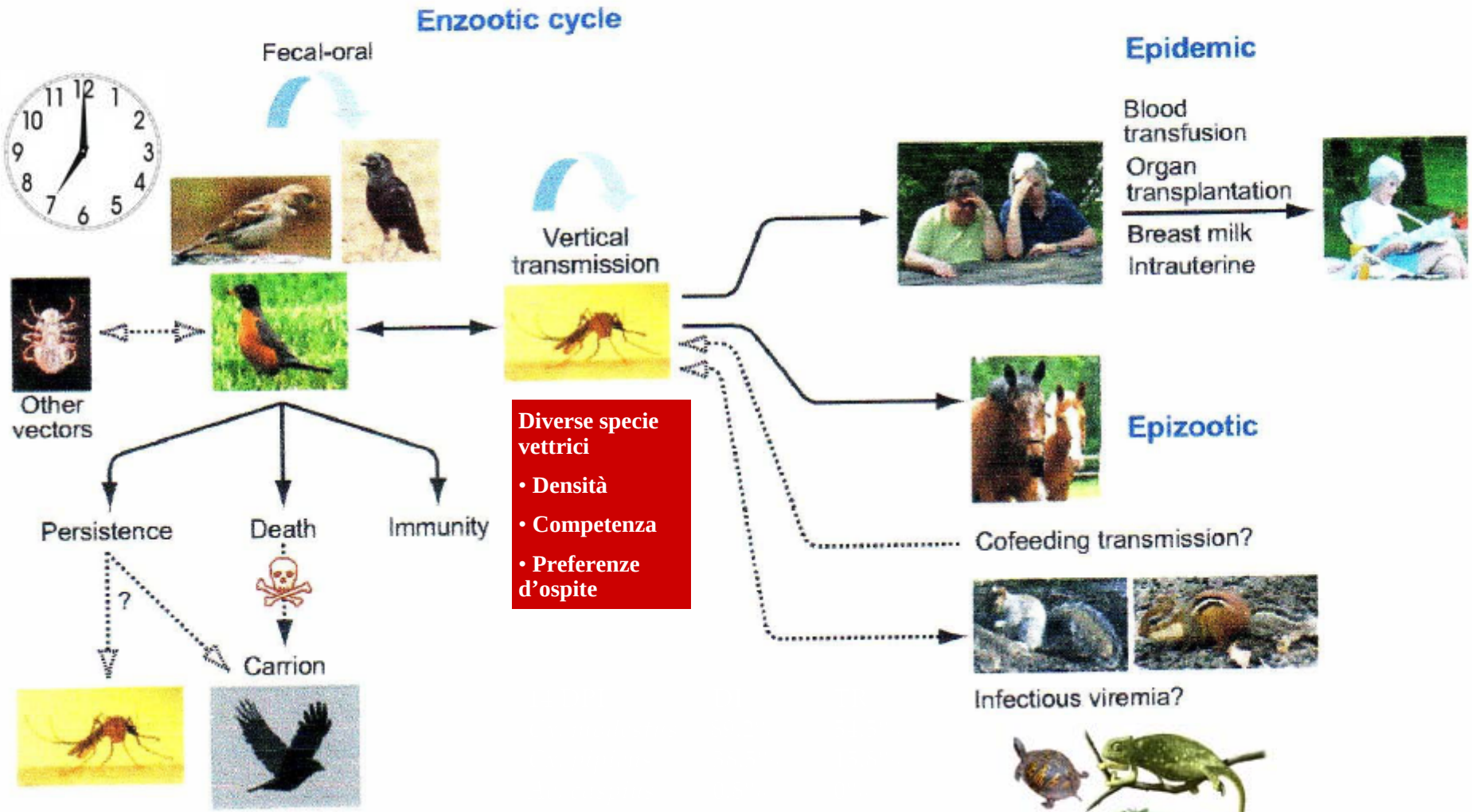
Species	n	Mean Days Infectious*	Mean Peak Viremia **	c_i***
Blue jay (Ghiandaia americana)	2	4	12.3	2.4
Common grackle	6	3	9.4	1.0
House sparrow (Passero)	6	3	8.9	0.9
House finch (Ciuffolotto messicano)	2	6	8.8	0.8
American robin (Pettirosso americ.)	2	3	8.5	0.6
Red-wing. blackbird (Merlo ali rosse)	3	3	8.1	0.5
Mallard (Germano reale)	2	3	6.7	0.3
European starling (Storno)	6	2	6.0	0.1
Canada goose (Oca del Canada)	3	0	4.7	0
American coot (Folaga americana)	1	0	4.6	0
Rock dove (Piccione)	6	0	4.3	0
Chicken	16	0	3.2	0
Ring-neck Pheasant (Tortora)	3	0	2.7	0

* Infectious viremia = log 5 or greater per ml serum; ** log pfu/ml serum

*** c_i = susceptibility * mean infectiousness * days infectious

Komar http://www.cdc.gov/ncidod/dvbid/westnile/misc/slides/komar/slide02.htm

WNV transmission cycle



Modificato da Kramer et al 2007

DPI day post infection
DI Disseminated infection
TR transmission rates
Balenghien et al. 2008
Vector competence of some French Culex and Aedes mosquitoes for West Nile virus

FLAVIVIRUS

YF DEN JE WN

ALPHAVIRUS

CHIKUNGUNYA

ENCEFALITI EQUINE AMERICANE

SINV

BUNYAVIRUS

TAHYNA

BATV

RVF

Tabella 1. Tabella riassuntiva dei principali arbovirus diffusi su scala globale con riferimento alle specie vettrici di culicidi, agli ospiti serbatoio e alla diffusione.

Virus	*Specie vettrici principali*	*Ospiti serbatoio*	*Diffusione*
Alphavirus			
Chikungunya	*Aedes aegypti*, *Ae. albopictus*, *Aedes* spp., *Culex* spp., *Mansonia africana*	Primati, pipistrelli	Africa sub-Sahariana, Sud est asiatico, Sri Lanka, India,
Mayaro virus	*Haemagogus janthinomys*	?	Sud America
Encefalite equina venezuelana	*Culex* spp.	Roditori, equini	Americhe
Encefalite equina dell'est	*Culiseta melanura*, (ciclo selvatico)	Volatili	Americhe
Encefalite equina dell'ovest	*Culex tarsalis* (ciclo selvatico) *Ochlerotatus* spp.	Volatili, lagomorfi	Americhe
Ross River virus	*Ochlerotatus vigilax*, *O. camptorhynchus*, *Culex annulirostris*	Mammiferi, in particolare marsupiali	Australia Isole del Pacifico
Barmah Forest virus	*Ochlerotatus vigilax*, *O. camptorhynchus*, *Culex annulirostris*	Mammiferi	Australia

Virus	*Specie vettrici principali*	*Ospiti serbatoio*	*Diffusione*
O'nyong nyong	*Anopheles funestus*, *A. gambiae*	?	Africa sub-Sahariana
Sindbis	*Culex* spp., *Culiseta* spp., *Aedes* spp.	Volatili	Europa, Africa, Asia Minore, Sud Asia, Australia,
Flavivirus			
Encefalite giapponese	*Culex tritaeniorhynchus*, *Culex* spp.	Volatili, maiale	Asia
West Nile	*Culex* spp.	Volatili	Tutto il mondo
Usutu	*Culex* spp.	Volatili	Africa, Europa
Encefalite St. Louis	*Culex* spp.	Volatili	Americhe
Encefalite della Murray Valley	*Culex annulirostris*	Volatili	Australia, Nuova Guinea
Kunjin	*Culex annulirostris*	Volatili	Australia, Nuova Guinea
Rocio virus	*Ochlerotatus scapularis*, *Psorophora ferox*	?	Brasile
Dengue	*Aedes aegypti*, *Ae. albopictus*, *Aedes* spp.	Primati	Africa, Americhe, Asia
Febbre gialla	*Aedes aegypti*, *Aedes* spp.	Primati	Africa, America centro-meridionale

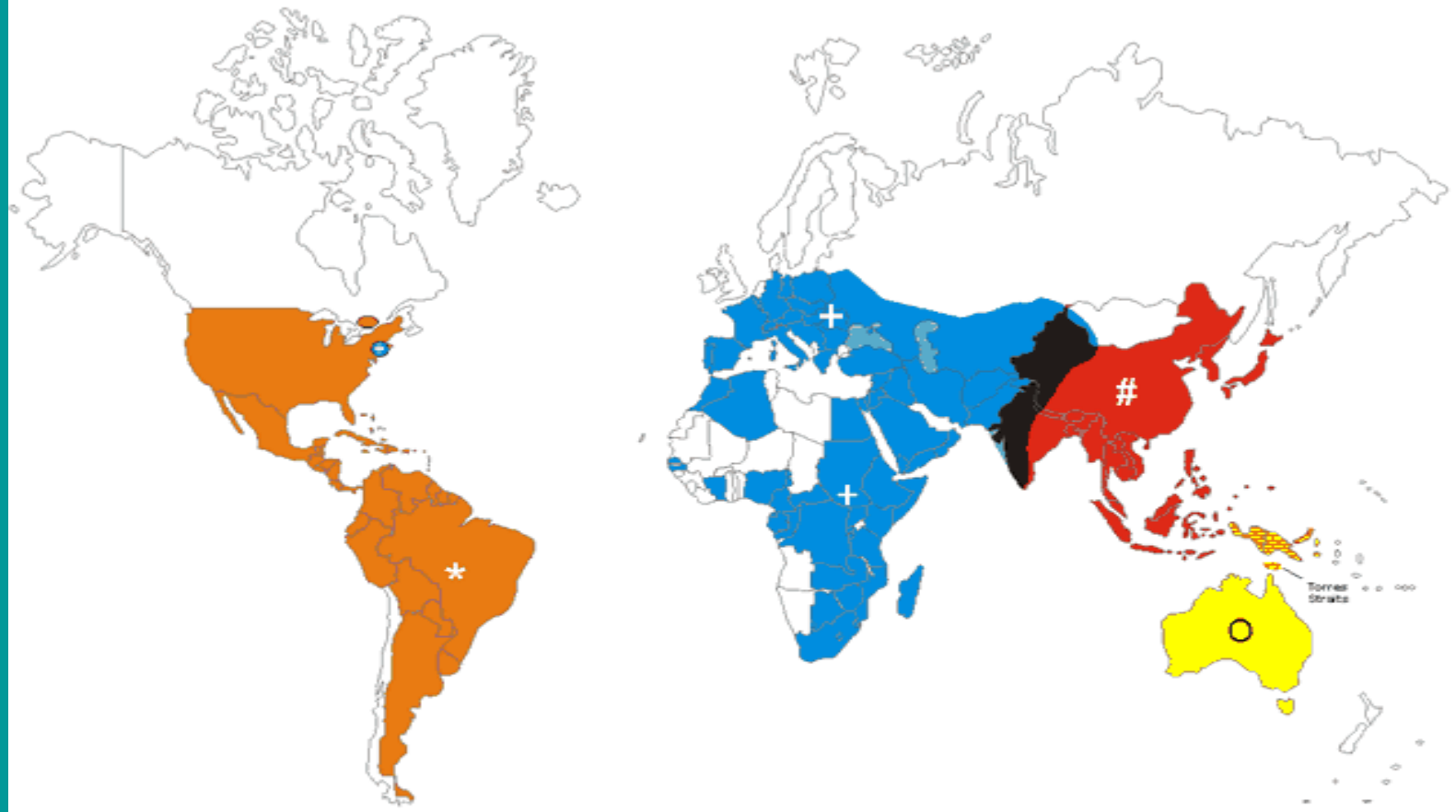
Virus	*Specie vettrici principali*	*Ospiti serbatoio*	*Diffusione*
Bunyavirus			
Rift Valley	*Aedes* spp., *Ochlerotatus* spp., *Culex* spp., *Mansonia* spp.	Mammiferi (in particolare ovini, bovini)	Africa
Encefalite LaCrosse	*Ochlerotatus triseriatus*	Roditori	Nord America
Tahyna	*Aedes vexans*, *Aedes* spp., *Ochlerotatus* spp.	Lagomorfi	Europa
Inkoo	*Aedes* spp., *Ochlerotatus* spp.	?	Nord Europa
Batai	*Anopheles* spp.	Mammiferi	Europa
Potosi virus	*Aedes* spp., *Anopheles* spp.	Ungulati	Nord America

JAPANESE ENCEPHALITIS VIRUS SERO GROUP

ALFUY, JE, KOUTANGO, KUNJIN

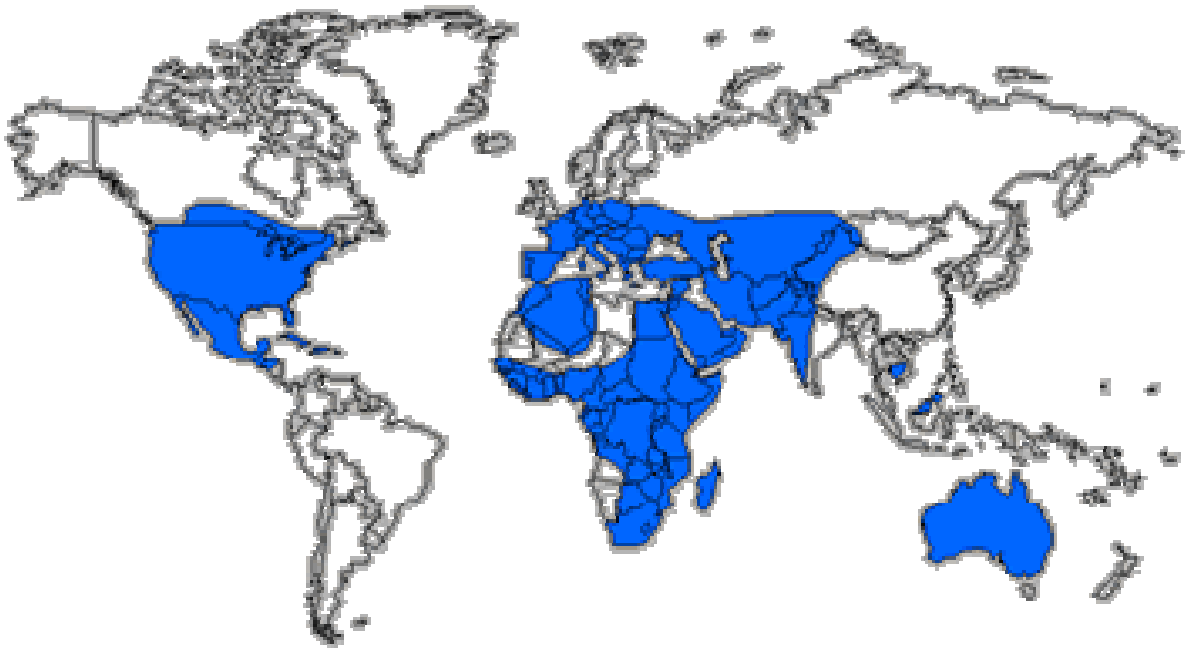
MURRAY VALLEY ENCEPHALITIS, ST. LOUIS ENCEPHALITIS, USUTU, WN, YAOUNDE

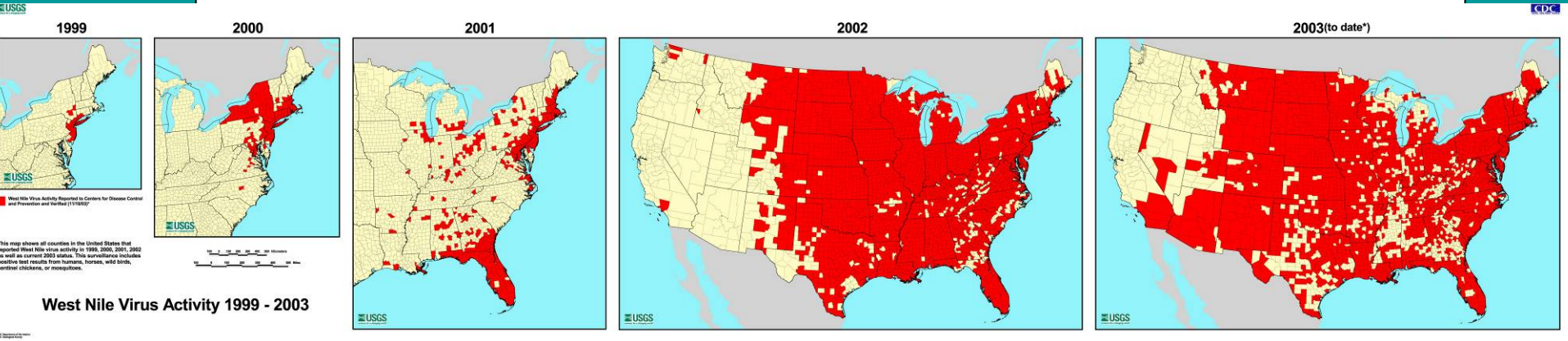
The Geographic Distribution of the Japanese Encephalitis Serocomplex of the Family Flaviridae, 2000.



- St. Louis encephalitis
- * Rocio and St. Louis (Brazil)
- + West Nile virus
- # Japanese encephalitis
- West Nile and Japanese encephalitis
- Japanese and Murray Valley encephalitis
- Murray Valley and Kunjin

West Nile Virus:
Approximate Geographic Range, 2003





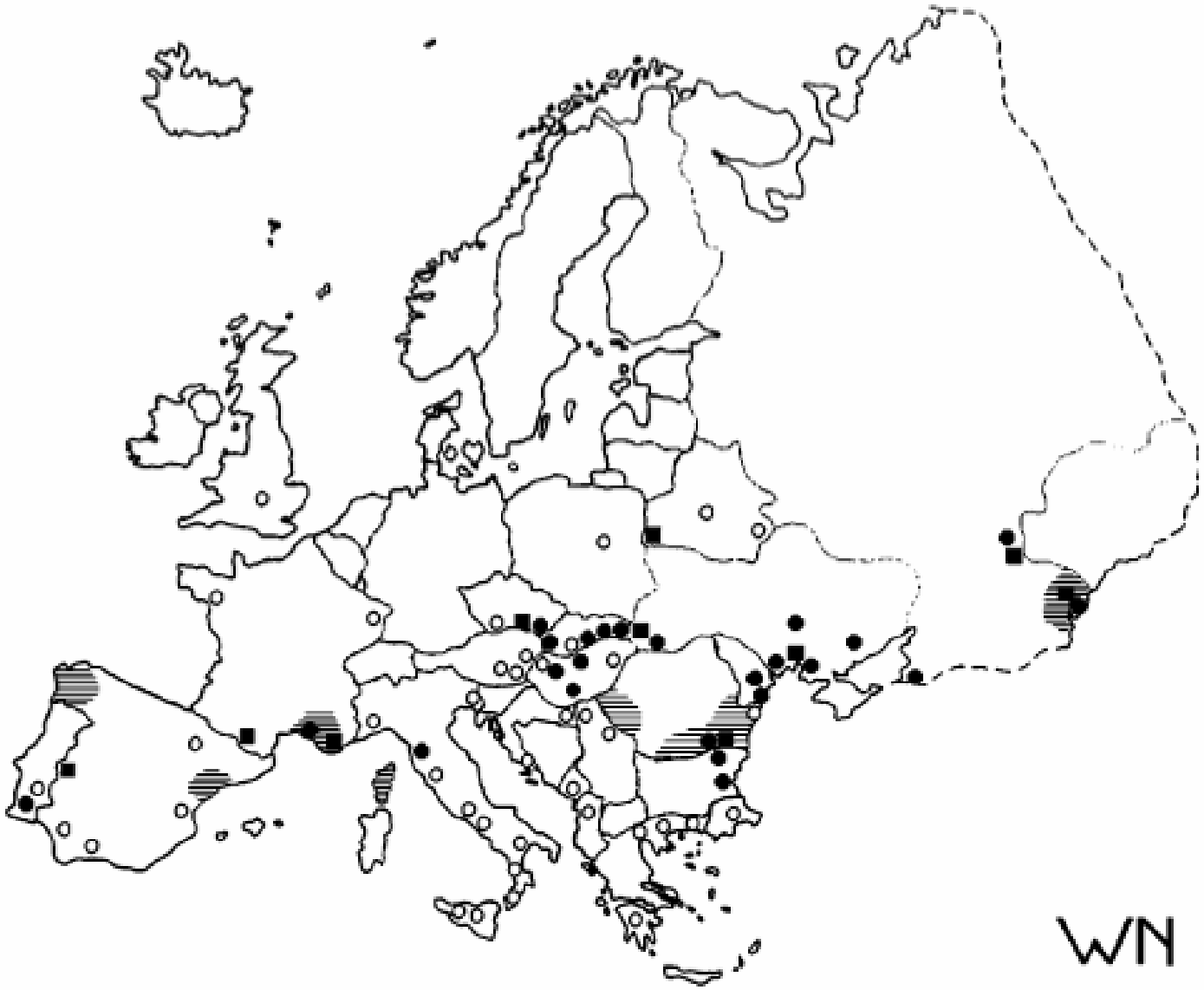
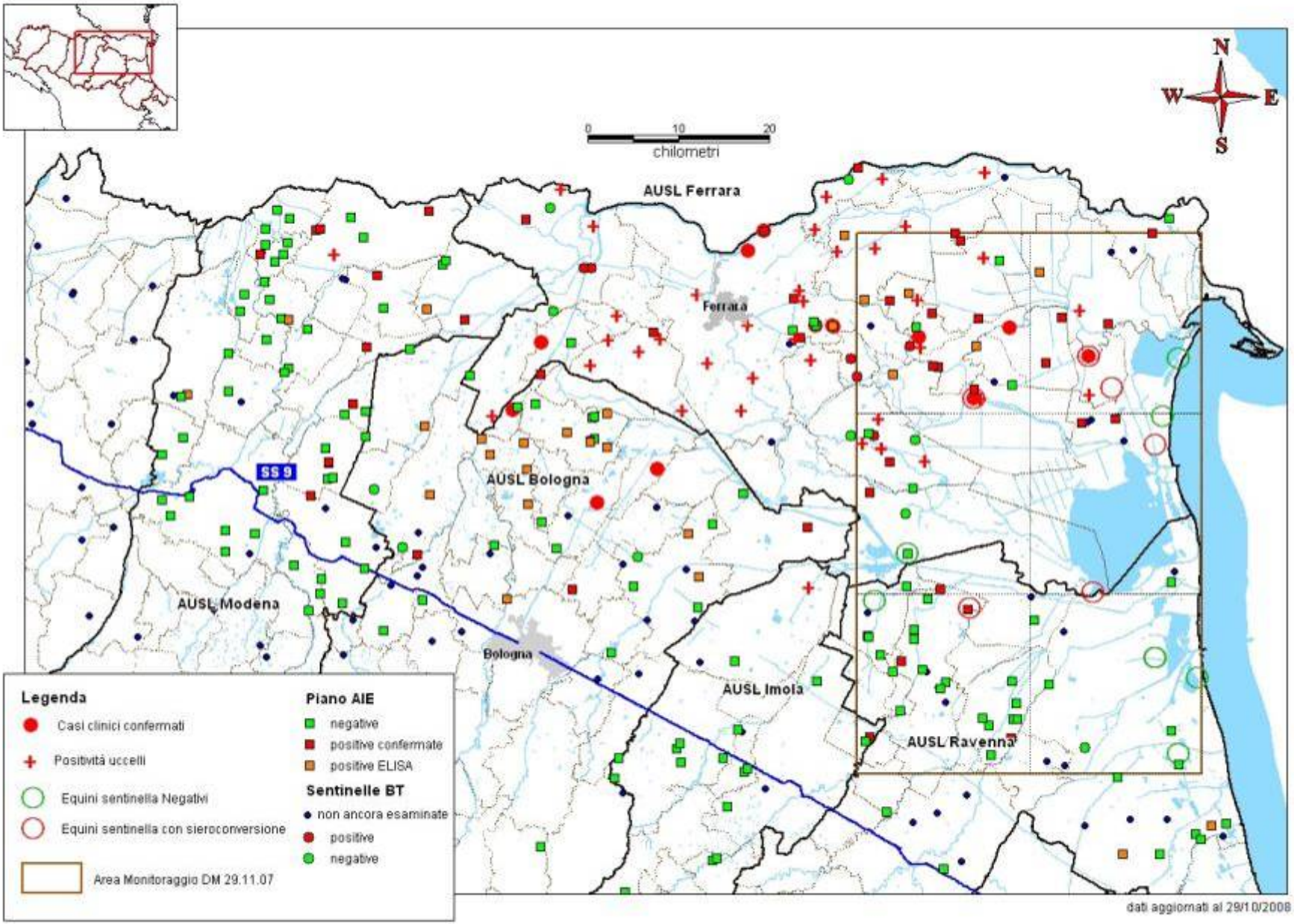


Fig. 2 Geographic distribution of moboviruses in Europe. Explanation: *black points*, the virus isolation; *black squares*, human infections; *white circles and hachures*, specific antibodies detected


N
W
E
S
0
10
20
chilometri
AUSL Ferrara
Ferrara
SS 9
AUSL Bologna
AUSL Modena
Bologna
AUSL Imola
AUSL Ravenna
Legenda
Casi clinici confermati
Positività uccelli
Equini sentinella Negativi
Equini sentinella con sieroconversione
Area Monitoraggio DM 29.11.07
Piano AIE
negative
positive confermate
positive ELISA
Sentinelle BT
non ancora esaminate
positive
negative
dati aggiornati al 29/10/2008

M. Tamba

Distribution of Japanese Encephalitis in Asia,

1970-1998

Source: Tsai TR,

Chang GW, Yu YX.

Japanese encephalitis

vaccines. In Plotkin

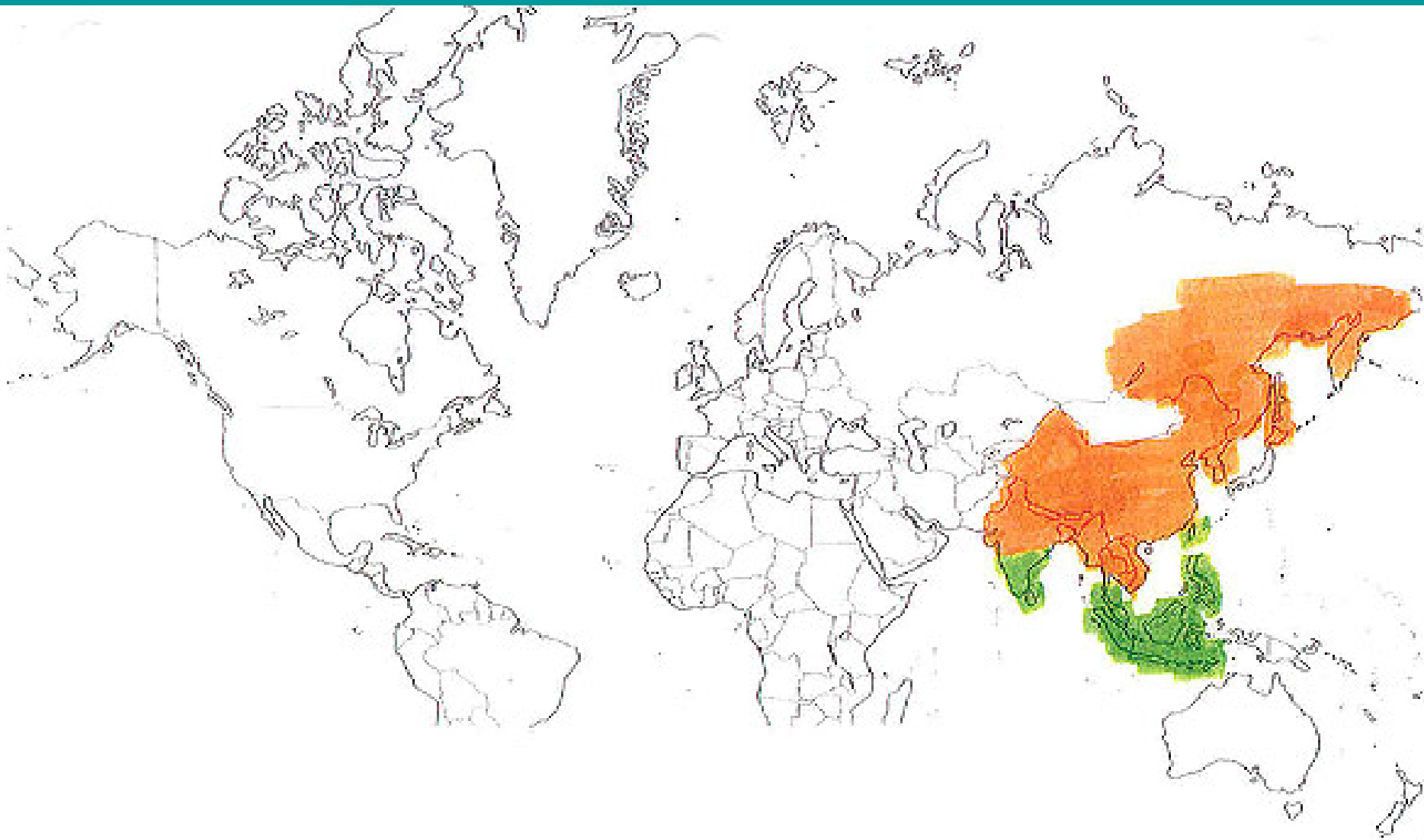
SA and Orenstein WA,

eds., Vaccines - 3rd edition,

WB Saunders, Inc., Philadelphia,

PA, 1999;672-710


Russia
Kazakhstan
Mongolia
China
Pakistan
Bhutan
India
Bangladesh
Burma
Laos
Thailand
Vietnam
Cambodia
Sri Lanka
Malaysia
Singapore
Indonesia
Taiwan
Philippines
Japan
South Korea
Saipan
Guam
Saipan
Guam
Papua New Guinea
Australia
Risk Areas for
Japanese Encephalitis



orange: temperate, mostly June thru September
green: tropical, endemic year-round, esp. rainy season

J. Japanese encephalitis

risk is highest in rural, agricultural areas with wet fields and swine

CALIFORNIA VIRUSES SEROGROUP

TAHYNA, INKOO , SNOWSHOE HARE

LACROSSE, SAN ANGELO, JAMESTOWN CANYON

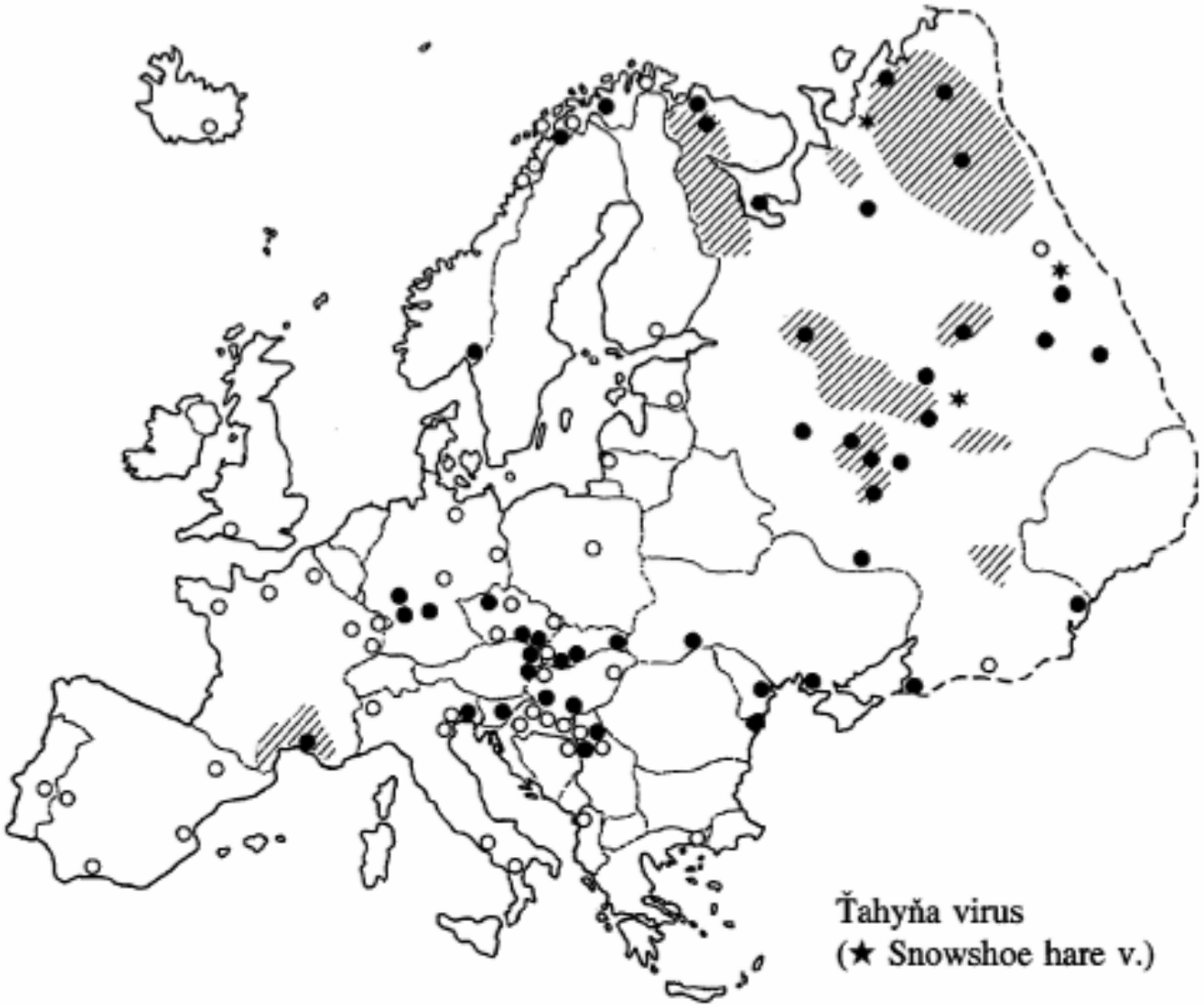


Fig. 3 Geographic distribution of moboviruses in Europe. Explanation: *black points*, the virus isolation; *white circles and hachures*, specific antibodies detected

Hubalek

2006

Fig. 4 Geographic distribution of moboviruses in Europe. Explanation: *black points*, the virus isolation; *white circles and hachures*, specific antibodies detected

Hubalek

2006