



RIVERS

Resistance of Influenza Viruses in
Environmental Reservoirs and Systems



Report of mission
Phnom Penh, Cambodia
from 15th to 23rd of October, 2007
Flavie GOUTARD and Annelise TRAN



CIRAD - Département EMVT – UR10
Epidémiologie et Ecologie des Maladies
TA 30/E, Campus international de Bail
34398 Montpellier cedex 5 - France



RIVERS is funded by the 6th
framework programme of the
European Commission under the
reference SSP –5–B-INFLUENZA



RIVERS

Resistance of Influenza Viruses in
Environmental Reservoirs and Systems

I. Objectives and course of the mission

This mission had two objectives:

- Follow-up of Avian Influenza projects started in 2007: project RIVERS (Cambodia) and project ECOFLU (Thailand)
- Meetings with the partners of Kasetsart University on the contents of the Epi-modules of the Binational Thai-French Joint Master program.

Planning:

Monday 15	Tuesday 16	Wednesday 17	Thursday 18	Friday 19	Monday 22
12h: Arrival at Phnom Penh	Field visits (provinces of Kampong Cham and Prey Veng)	Meetings RIVERS in Pasteur Institute and Department of animal Health.	Meeting SCAC Bangkok (A. Malac)	FAO	Meeting ECOFLU (Mathilde Paul)
Meetings at the Pasteur Institute of Cambodia on RIVERS project.		Meeting SCAC Phnom Penh (J. Morcos) Midnight: Arrival in Bangkok	Meeting Kasetsaert (Dr. Sirachai) Meeting ECOFLU (Mathilde Paul)	IRD (Mr. Tibayrenc + A. Leconte) SCAC regional delegation (Mr. Siveton)	

II. Project RIVERS

The main goals of the meetings and the field visit were to give a progress report on the availability of epidemiologic data, the activities to be set up, the role of each research team, in order to lead to a work schedule for 2008. Franek Rakowski, of ICM Warsaw, was also part of the mission for better defining the activities of modelling to be realized within the framework of RIVERS.

1. People met

Participants in RIVERS Project	
Dr Sirenda Vong	Medical epidemiologist, IPC
Franek Rakowski	modelisator, ICM Poland
Dr Sowath Ly	epidemiologist, IPC
Other people met, in bond with the project	
Dr Holl Davun	Ministry of Agriculture, Department of Animal Health, in charge of the surveillance of the avian influenza in poultry
Dr Heng Kiri	Ministry of Agriculture, Department of Animal Health
Dr Philippe Cavaille	epidemiology, IPC
People absent at the time of our visit	
Maria Vankerkhof	Study social network on influenza, IPC
Dr Philippe Buchy	Virology, IPC



RIVERS

Resistance of Influenza Viruses in
Environmental Reservoirs and Systems

2. Field Visit

Present: Flavie Goutard, Annelise Tran, Franek Rakowski, Sowath Ly

Visited provinces: Kampong Cham and Prey Veng, two provinces with the strongest densities of chickens.

Visits of several infected villages (1 with human case in 2006, 2 villages with poultry outbreaks)

Description of the soil occupancy: rice plantations, lakes, wetlands, zones of scattered settlements or/and high density.

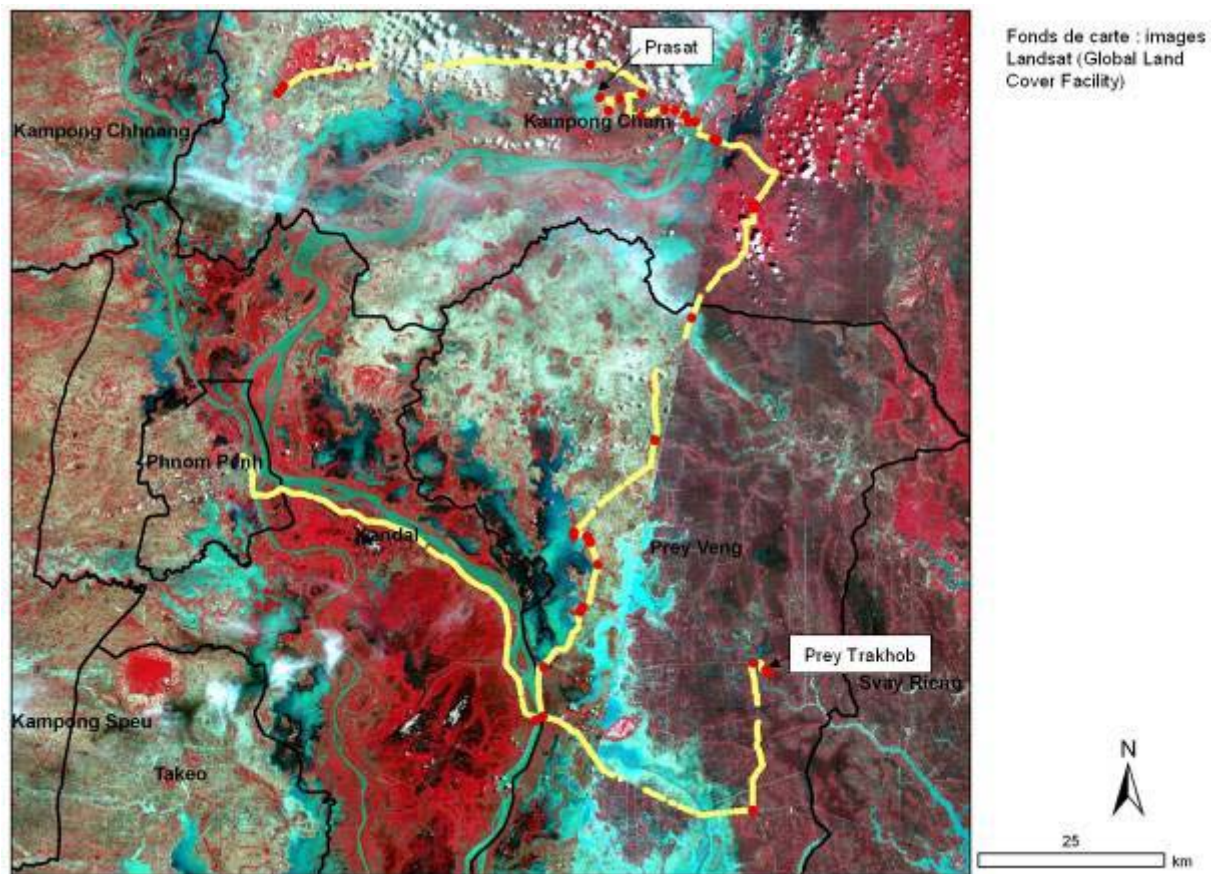


Figure 1 : Route followed from Phnom Penh in yellow ; stops in red ; administrative limits of provinces in black

This visit enables us to better realize the type of environment of the infected zones and to understand how poultry farms are organised:

- Chickens: homogeneous distribution, always some chickens in each house, moving freely
- Ducks: distribution much more heterogeneous according to villages, some ducks in each house (like chickens), or flocks (approximately 200 ducks) penned near the houses, or flocks (approximately 200) parked in flooded zones far from villages.



RIVERS

Resistance of Influenza Viruses in
Environmental Reservoirs and Systems

Other remarks:

- in each house, overcrowding and mixing of several species, chickens, ducks, pigs, cattle, dogs...
- large quantity of shells around the lakes
- presence of few wild birds (some white Egret)
- small ponds in the vicinity of the houses



3. Definition of the activities of the work package 9 “modelling” implying the ICM, the Pasteur Institute of Cambodia and the CIRAD:

These activities, which include field, epidemiological, spatial and modelling studies, complement each other and will be based on the experimental studies carried out by the other teams - noted (0) thereafter - within the framework of the RIVERS project on the favourable conditions for the survival of virus (temperature of water, pH,...).

a. Field measurements

i. Follow-up of the water characteristics

The physical parameters of water tested within the framework of the experimental studies (0) will be measured in the field in various villages, this in order to evaluate if the environmental conditions in Cambodia allow or not the survival of the virus in water. For that, series of



RIVERS

Resistance of Influenza Viruses in
Environmental Reservoirs and Systems

measurements 4 times in the year (maximum rain season, dry season, and intermediate moments) have to be considered.

Organization:

Flavie and Annelise are given the responsibility to establish a proposal for a measurement protocol (which parameters and how) by contacting the teams implied in (0) and with experts in hydrology (ex: Maison of Water, Montpellier). **Dead-line:** mid-December

Sirenda and Sowath will be able to then evaluate the cost of such measurements.

Dead-line: at the end of 2007.

The funding of the field measurements will have to be discussed with Jan Radomski (coordinator of the work package 9) because no funds are available for this activity at the Pasteur Institute in Cambodia. Installation and follow-up of the protocol: Sirenda and Sowath for 2008.

ii. Follow-up of outbreaks environment

After each outbreak declaration (human case, epizooty in chickens), the environment close to the farms is prospected (water, vegetation, deposit, mud, soil...) and the presence of the virus is searched. The time between the epidemic and the date of the sample collection is noted.

Organization:

P. Buchy (IPC), Sirenda, Sowath, according to an improved protocol.

b. Study on the epidemiological surveillance system

Data from the surveillance carried out on 6 provinces of Cambodia (including Kampong Cheng and Prey Veng) will be analysed in order to study the spatial distribution of AI outbreaks, and, in the case of a spatial heterogeneity, to identify environmental risk factors being able to explain this heterogeneity (cf. point c. and d.). These risk factors will be connected for their analysis with the results of (0) and (a.i.).

For that, the data base of the surveillance system for the 6 provinces since 2004 must initially be cleaned and standardized. The analysis of this data base will enable the evaluation of the current surveillance system and will lead to the formulation of proposals to improve it.

Organization:

This work will be the subject of a Master degree student for his professional training, from January to June 2008, based in Phnom Penh.

Dead-line:

Definition of the subject: Sirenda -> end of October

Selection of the candidate: Flavie -> November

Identification of a grant (Pasteur): Sirenda -> November

c. Remote sensing analysis

Two scales of study have been identified: a study at regional scale on the six provinces for which epidemiological data are available, for the study of risk factors (b.); a study on a local scale on a small zone to test feasibility to characterize risk environmental parameters (0) on a village scale.

i. Regional scale

Data on the soil occupancy will be compared with the epidemiologic data (b.). The temporal variations of flood will be taken into account by the analysis of time series of MODIS images.



RIVERS

Resistance of Influenza Viruses in
Environmental Reservoirs and Systems

ii. Bibliographical review

A bibliographical review on the contribution of remote sensing for the characterization of water properties ($T^{\circ}\text{C}$, pH, turbidity, etc: cf 0) will be carried out. If possible, these parameters will be calculated on the study area where these parameters will have been measured on the ground (cf a.i.) for validity test (purchase of spatial images required).

Organization:

This work will be the subject of a Master degree student for his professional training (standard "Teledetection and Géomatique applied to the environment", Paris 7) first half of 2008, based in Montpellier.

Dead-line:

Definition of the subject: Annelise -> at the end of November

Selection of the candidat/e: Annelise -> December

Purchase of MODIS images: Annelise -> January 2008

d. Modelling

Given the available data, a model of general transmission seems difficult to implement for the moment so several studies calling upon modelling were identified.

i. Data analysis (b. and c.)

Detection of clusters

Correlation analysis and spatial regression

ii. Data analysis (0. and a.i.)

Proposing a system of differential equations in order to link the field data and the theoretical model of virus survival. (ideally, so as to propose for each villages, a real survival curve)

Analyse of model validity.

iii. Comparison of derivate function

Identification of other parameters than water properties that could influence the survival of the virus and evaluate impacts of these parameters (ex: density of poultry / ducks / breeding systems etc...)

iv. Supplementary models

For the characterisation of water properties by remote sensing plus meteorological data, study on the modelling of energy transfer ($T^{\circ}\text{C}$) between water and air.

Organisation:

Franek will be in charge of these four last studies:

- starting with current available data
- drawing up a list of ideal parameters needed to model the survival of virus in water (making the link between 0., a.i. and a.ii.)



RIVERS

Resistance of Influenza Viruses in
Environmental Reservoirs and Systems

4. Various meetings:

Name	Organism	Remarks
Jean-Louis Sarthou	Director of IPC	
Frédéric Arieu	Molecular epidemiologist	Development of remote sensing project on Malaria (in the process, keeping in touch about what is done on RIVERS and CEROPATH in order to build a common data base on environmental data of Cambodia)
Jean-Michel Garcia	Postdoctoral Fellow IP Hong-Kong	Development of serological screening test on H5N1 _ possible collaboration
Jacques Morcos	Attaché for scientific cooperation at the French embassy of Cambodia.	Presentation of project.