Plague sentinel site surveillance system and opportunities for future studies related to rodents in Vietnam

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Content

- **Background**
- **Goals and Objectives**
- **Surveillance components**
- **Results 2018**
- **Active control of vectors and hosts**
- **Proposals for future studies related to rodents**

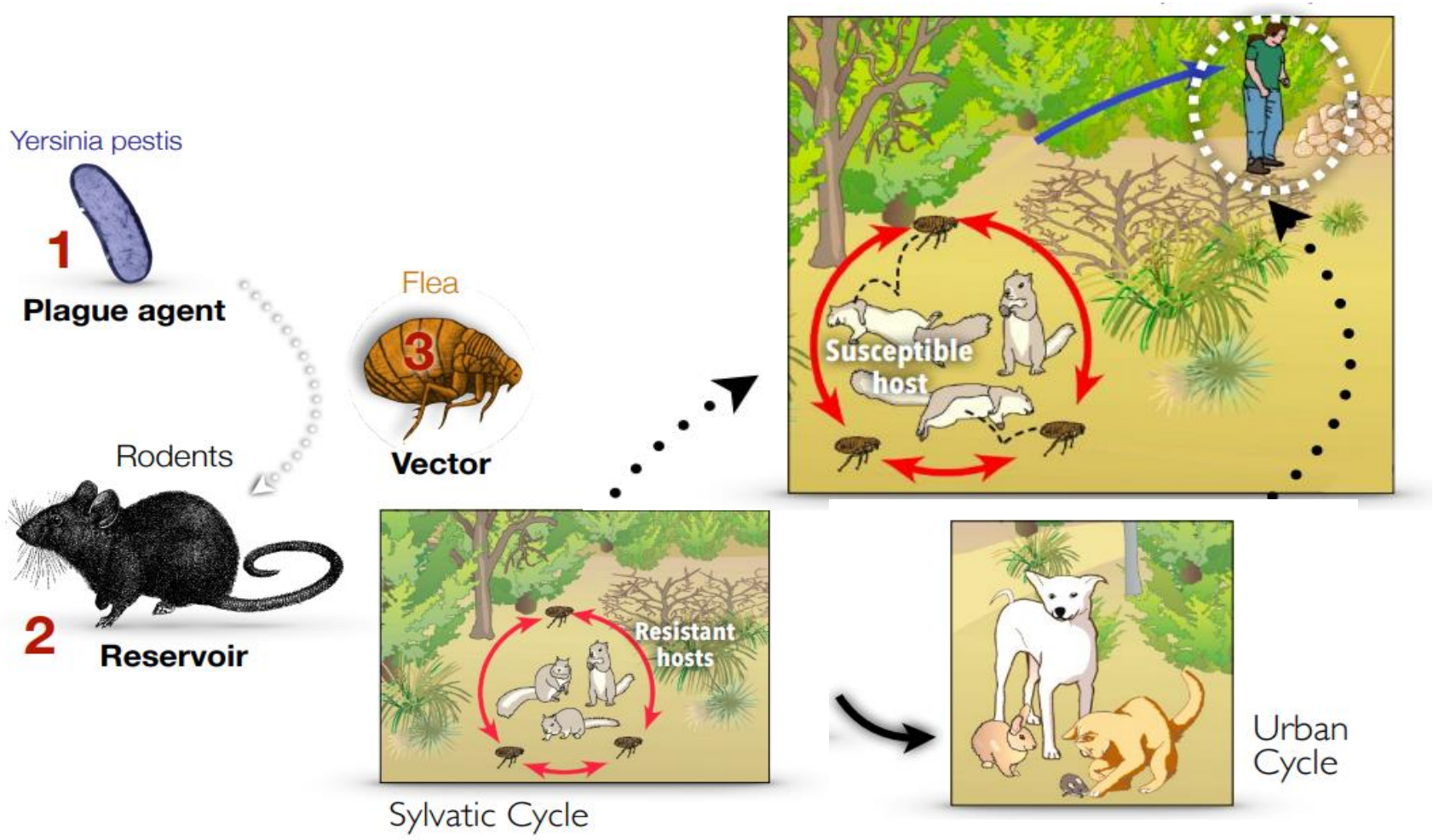
History of Plague in Vietnam

1898: first case from HongKong via ships.

Five periods:

1. *Imported and transmision to community: 1898-1922*
2. *Quiet and endemic: 1923-1960*
3. *Re-emerge in a large scale: 1961-1990*
4. *Endemic and quiet: 1991-2002*
5. *Under control: 2003 - now*

Cycle of transmission



Goal of the surveillance

Enhance the capacity in plague control and prevention by implementing the surveillance system to actively detect human cases of plague transmitted into Vietnam via points of entry and actively monitor rodents and flea activities in areas bordering China and Laos.

Objectives

(1) To early detection of plague human cases and in rodents

(2) To identify and monitor rodent and flea species in surveillance sites

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Components

1. **Human surveillance**

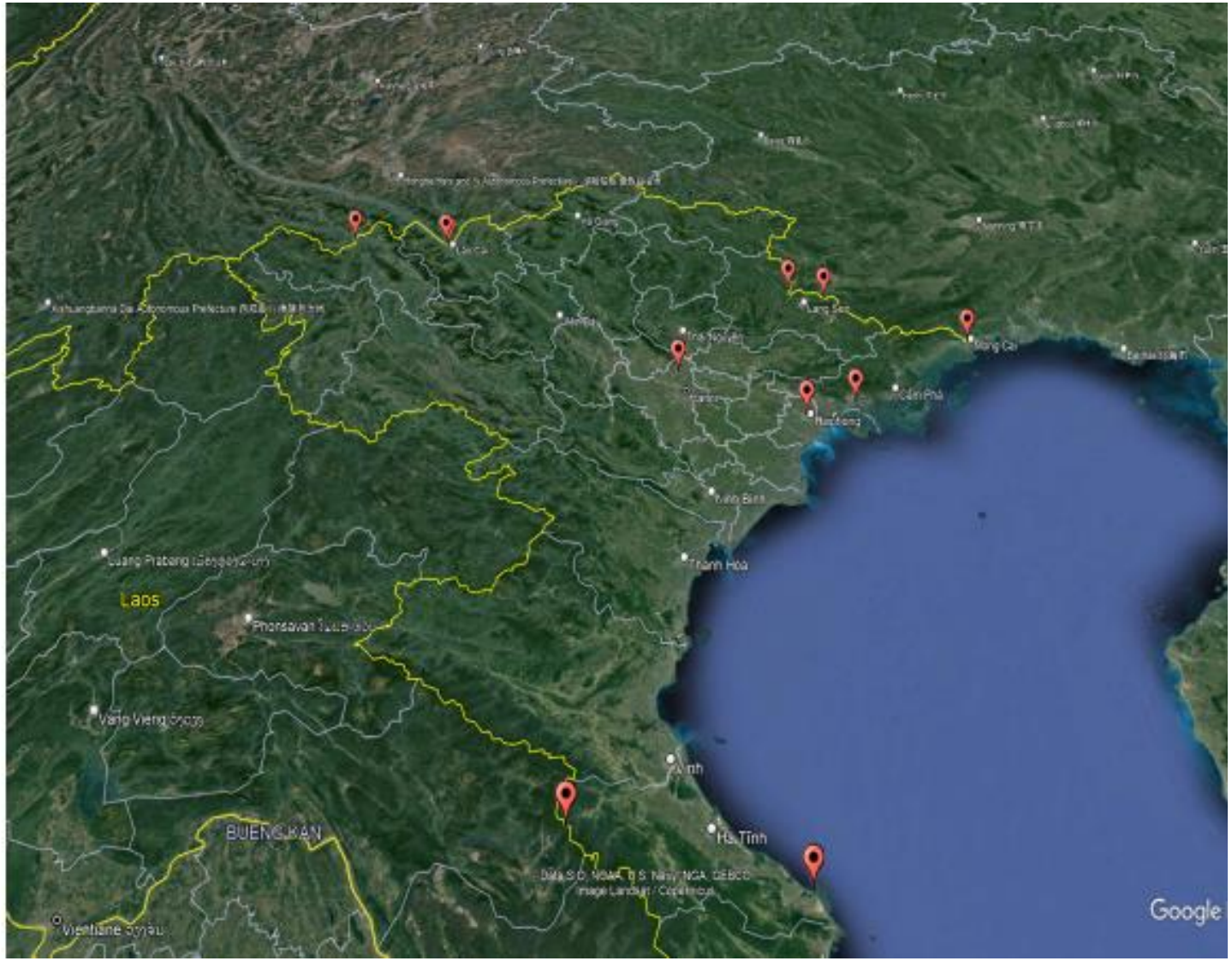
Using the WHO case definition for plague:

https://apps.who.int/iris/bitstream/handle/10665/341851/WER9624-eng-fre.pdf

Table 1 **WHO plague case definition**
Tableau 1 **Définition standard du cas de peste**

Plague case – Cas de peste	**Suspected – Suspect**	**Probable – Présumé**	**Confirmed – Confirmé**	**Not-a-case – Non cas**
Clinical and context – Contexte clinique et épidémiologique	Clinical presentation suggestive of plague AND Epidemiological context suggesting possible exposure to plague (exposure to infected humans or animals, or residence in or travel to a known endemic focus within 10 days prior to onset of the disease) Tableau clinique évocateur de peste ET Contexte épidémiologique évocateur d'exposition (exposition à des personnes ou des animaux infectés, résidence ou retour d'un foyer endémique connu dans les 10 jours précédant le début de la maladie)			
Tests – Tests	NONE – AUCUN	AND ONE of the following: • F1 antigen positive in bubo aspirate, sputum, blood, or post-mortem tissues by F1RDT or DFA • Single anti-F1 serology positive without evidence of previous *Y. pestis* infection or vaccination • Direct microscopy in a clinical sample, positive for gram-negative coccobacilli that display bipolar staining with Wayson or Giemsa stain ET UN des tests suivants positif: • Détection de l'antigène F1 par TDR F1 ou DFA dans un prélèvement de bubon, de sang, un crachat ou un prélèvement de tissu post-mortem • Une sérologie anti-F1 unique sans signe d'infection antérieure par *Y. pestis* ni de vaccination • Examen microscopique d'un échantillon clinique mettant en évidence des coccobacilles à Gram négatif, bipolaires après une coloration de Wayson ou de Giemsa	AND at least ONE of the following criteria: • Isolation of *Y. pestis* from a clinical sample - must have appropriate colony morphology and be identified as *Y. pestis* based by at least two of the following: o phage lysis at 20-25°C o biochemical profile o F1 antigen detection • Seroconversion or a 4-fold difference in anti-F1 antibody titer in paired serum samples drawn at least 2 weeks apart • *Y. pestis* DNA positive by species-specific PCR on either clinical sample or culture according to standard practice ET au moins UN des tests suivants positif: • Identification de *Y. pestis* dans un échantillon clinique sur la base de la morphologie de la colonie et au moins DEUX des tests suivants: o Lyse des cultures à 20-25°C par un phage spécifique o Profil biochimique de *Y. pestis* o Détection de l'antigène F1 • Séroconversion ou multiplication par 4 du titre d'anticorps anti-F1 dans des échantillons de sérum appariés prélevés à au moins 2 semaines d'intervalle • Détection d'ADN de *Y. pestis* par PCR dans un échantillon clinique ou sur culture, selon la technique conventionnelle	AND either: • at least TWO of the following laboratory tests (F1RDT, DFA against F1 antigen, direct microscopy, convalescent serology, culture, PCR) are conducted AND they are negative **OR** • When no confirmatory tests can be performed, TWO negative F1RDT on two clinical specimens collected with 24 hours interval ET soit: • Au moins DEUX des tests suivants sont effectués ET sont négatifs : TDR F1, détection de l'antigène F1 par DFA, examen microscopique, sérologie de convalescence, culture, PCR **OU** • Lorsqu'aucun test de confirmation n'a pu être effectué, DEUX TDR F1 sont négatifs sur deux échantillons cliniques prélevés à 24 heures d'intervalle

DFA: direct fluorescence assay; DNA: deoxyribonucleic acid; F1RDT: rapid diagnostic test based on F1 antigen; PCR: polymerase chain reaction. – DFA: examen par immunofluorescence directe; TDR F: test de diagnostic rapide basé sur l'antigène F1; PCR: de l'anglais «polymerase chain reaction».



Components

1. **Human surveillance**

Location:

- 11 Points of Entry (PoE) bordering China, Laos

Method:

- Screening at PoE by body temperature and health declaration to detect suspected cases.
- Reports from hospitals

If a suspected case detected, specimens will be taken for testing to confirm.

Components

2. Rodent and flea surveillance

- Location: 11 PoE areas
- Method: Data on domestic fleas and rodents were obtained by using traps monthly in accordance with the WHO guidelines
  - Classification of rodents and fleas
  - Take rodent samples (livers/spleen/kidney) for testing
- Take flea sample for PCR and for testing for chemical sensitivity or resistance.

Components

2. Rodent and Flea surveillance

- Rodent index: number of rodents/#traps per time.
- Flea index: average number of fleas/a rodent, by month, by sites
- Review of indexes: high, average or low

Components

3. Enhance capacity

- Provide one training course to update the surveillance guideline anually.
- Provide lab training for Wayson microscopic staining procedure to early detect Yersinia pestis for International Health Quarantine Centers
- Workshop for surveillance results

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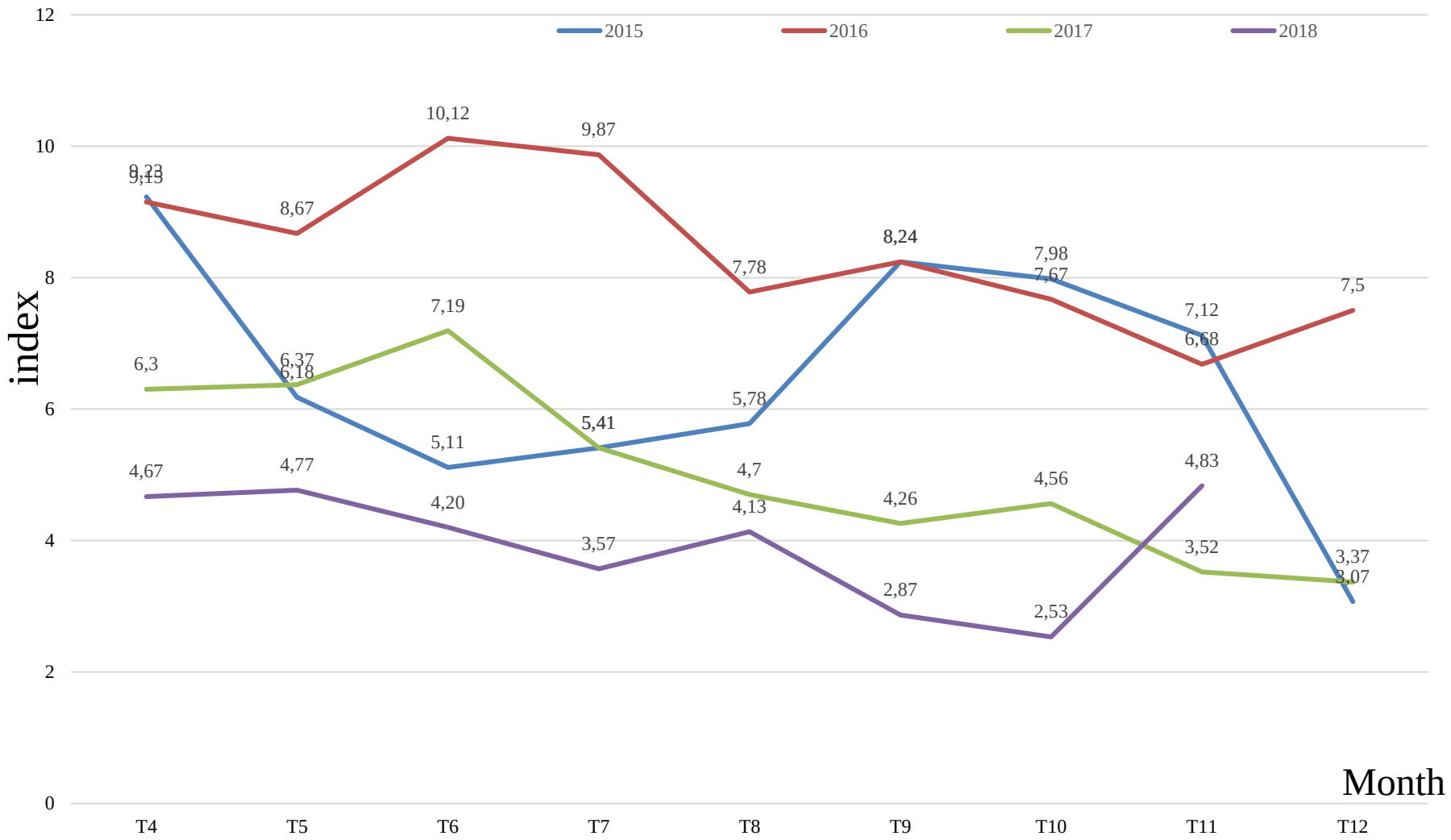
Rodent index by month, 2015-2018



Rodent index, 2018

TT	Sites	PoE	Rodents	Fleas	Flea index
1	Lào Cai	Lào Cai	56	33	0.59
		Kim Thành	48	17	0.35
2	Lạng Sơn	Hữu Nghị	57	4	0.07
		Tân Thanh	51	3	0.06
3	Hải Phòng	Cảng HP	31	42	**1.35**
4	Quảng Ninh	Móng Cái	11	0	0.00
		Cảng Hòn Gai	10	3	0.30
5	Hà Nội	Nội Bài	44	19	0.43
6	Hà Tĩnh	Cảng Vũng Áng	25	2	0.08
		CK Cầu Treo	22	6	0.27
		Tổng số	**355**	**129**	**0.36**

Flea index, 2018

TT	Trung tâm	CK	T3	T4	T5	T6	T7	T8	T9	T10	T11	TB
1	Lào Cai	Lào Cai	0.50	2.50	0.75	0.14	0.17	0.00	0.67	0.44	0.29	**0.59**
		Kim Thành	0.00	0.75	0.00	0.40	0.00	0.00	0.60	0.57	0.33	**0.35**
2	Lạng Sơn	Hữu Nghị	0.00	0.00	0.00	0.00	0.22	0.00	0.33	0.00	0.17	**0.07**
		Tân Thanh	0.10	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.20	**0.06**
3	Hải Phòng	Cảng HP	0.20	0.50	2.00	**6.33**	3.50	0.75	0.00	0.00	0.67	**1.35**
4	Quảng Ninh	Móng Cái	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
		Cảng Hòn Gai	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	**0.30**
5	Hà Nội	Nội Bài	0.80	0.00	0.67	0.00	0.50	0.40	0.50	0.00	0.71	**0.43**
6	Hà Tĩnh	Cảng Vũng Áng	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	**0.08**
		CK Cầu Treo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	1.50	**0.27**
	TB		**0.16**	**0.38**	**0.37**	**0.69**	**0.44**	**0.42**	**0.21**	**0.60**	**0.39**	**0.36**

Chemical sensitivity, 2018

		Death (%)					
		Hà Nội	Hải Phòng	Lạng Sơn	Hà Tĩnh	Lào Cai	Quảng Ninh
Chemical	Malathion 5%	65.2	60.8	67.3	67.3	66.7	62.3
	Deltamethrin 0.05%	79.6	70.3	82.3	82.5	68.7	75.3
	Permethrin 0.75%	**93.0**	86.7	**92.3**	**91.7**	89.7	**90.3**

Contents

Flea controls

RODENT CONTROLS

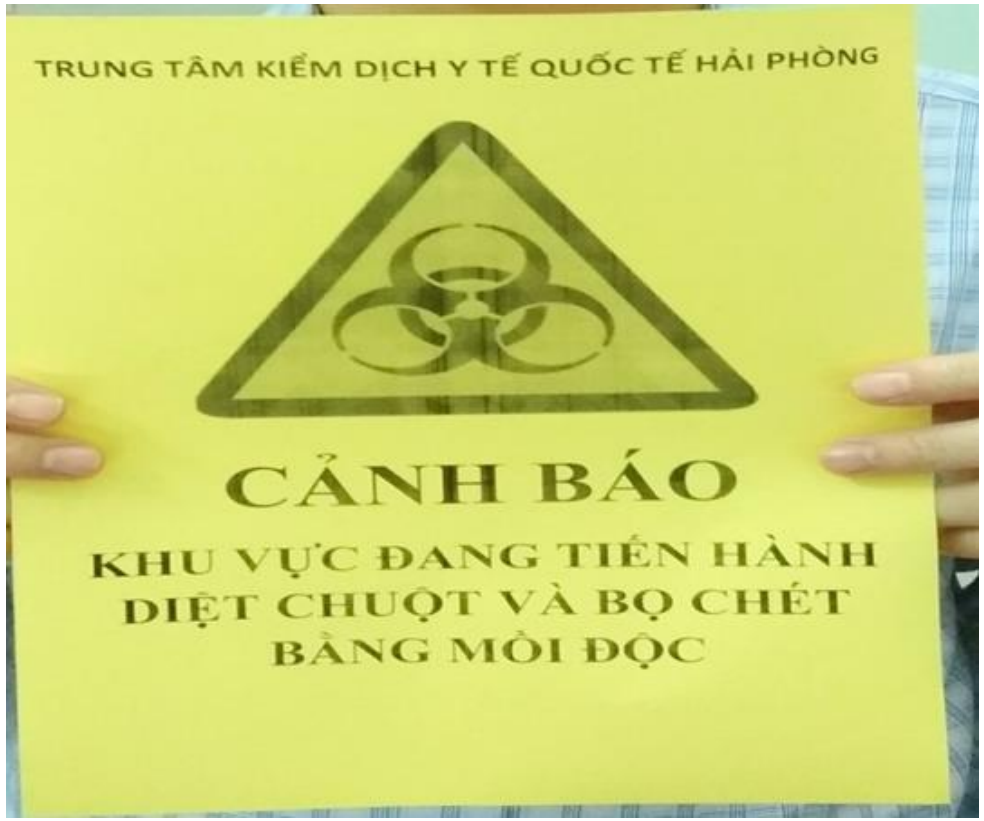
- Permethrin 50EC;

  0,2gr/m2

- Baits: Klerat and Storm

Rodent controls

Rodent controls

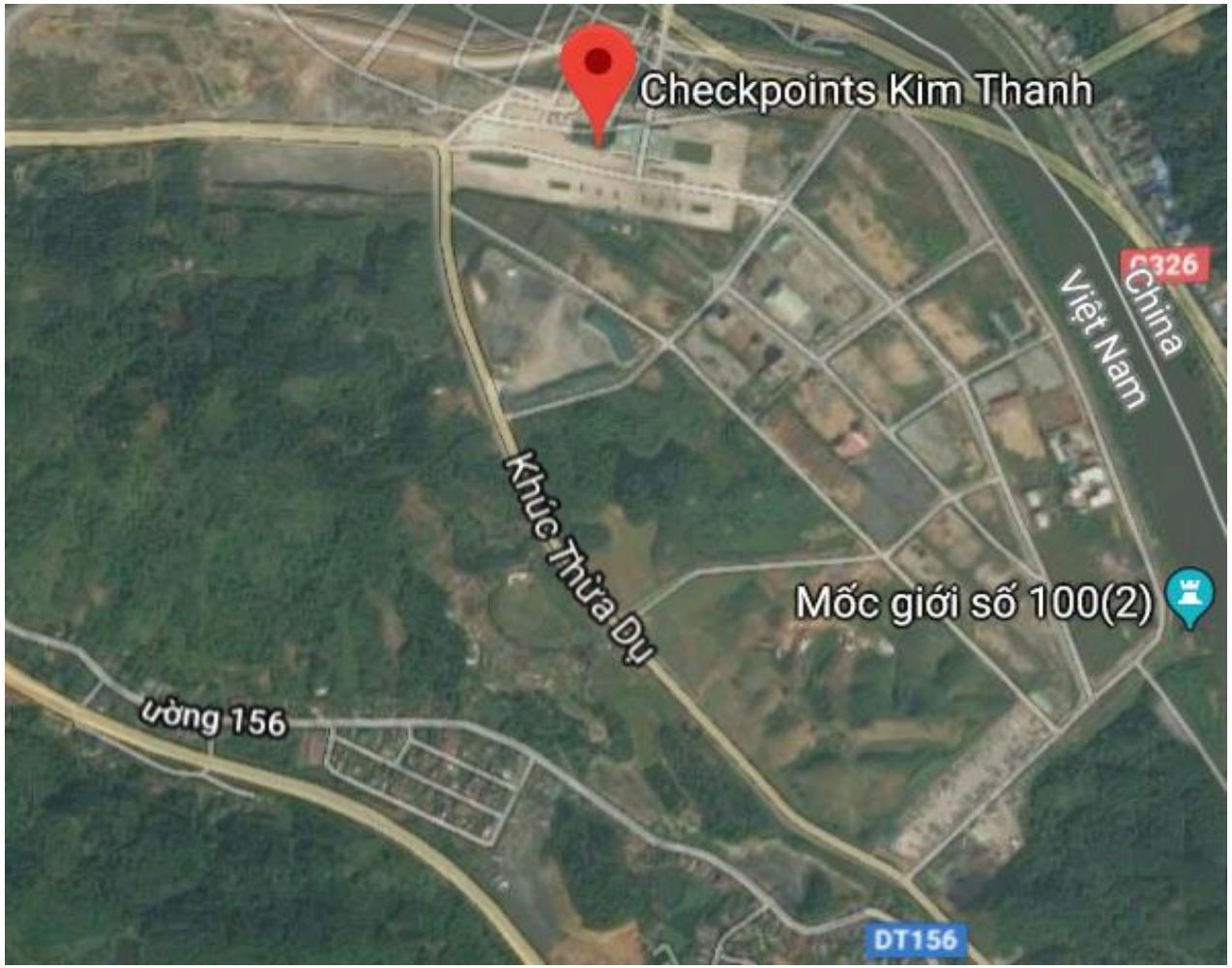


Before

After (2 days)

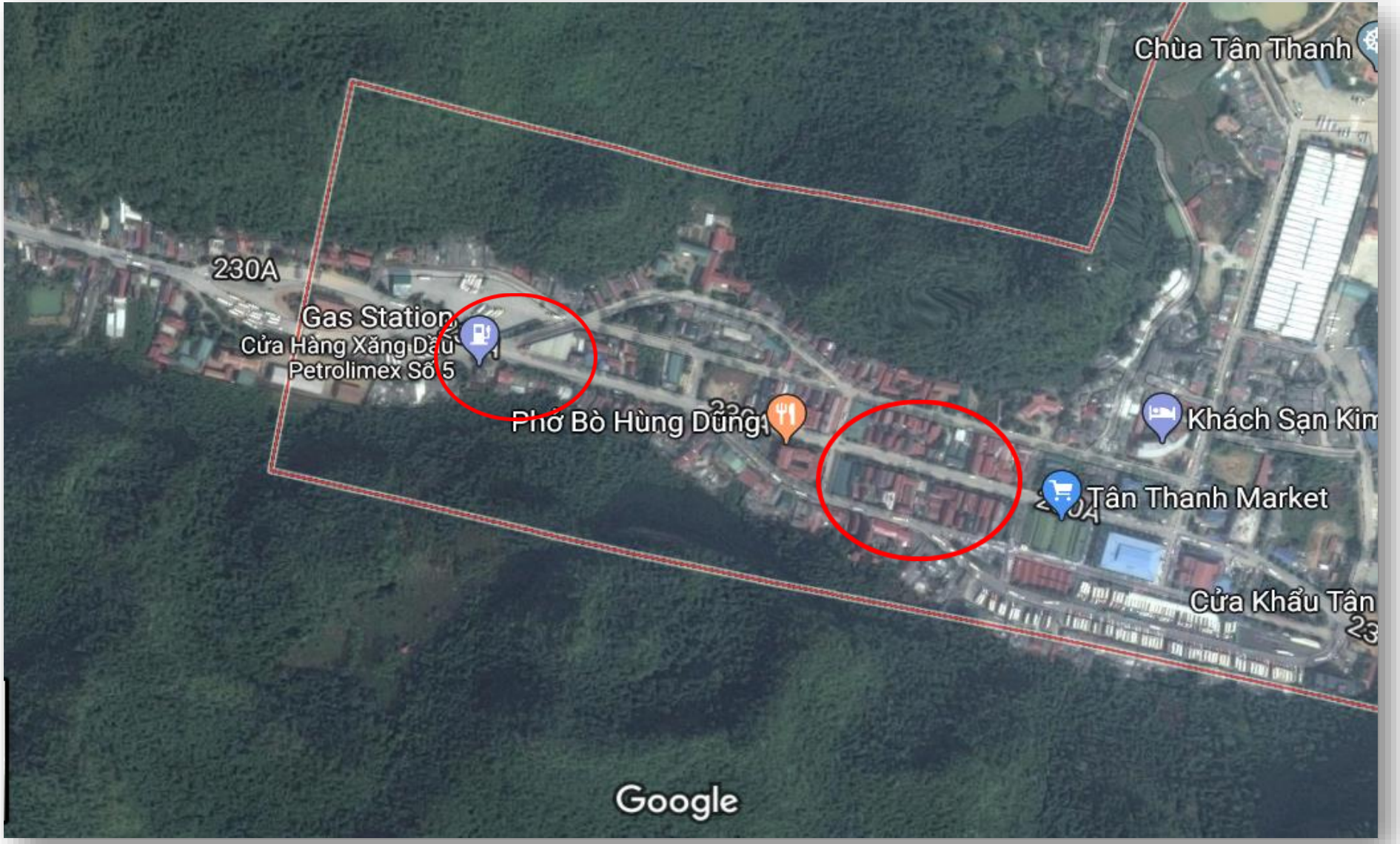
RODENT AND FLEA SURVEILLANCE

Kim Thanh PoE, Lao Cai Province



RODENT AND FLEA SURVEILLANCE

Tan Thanh PoE – Lạng Son Province

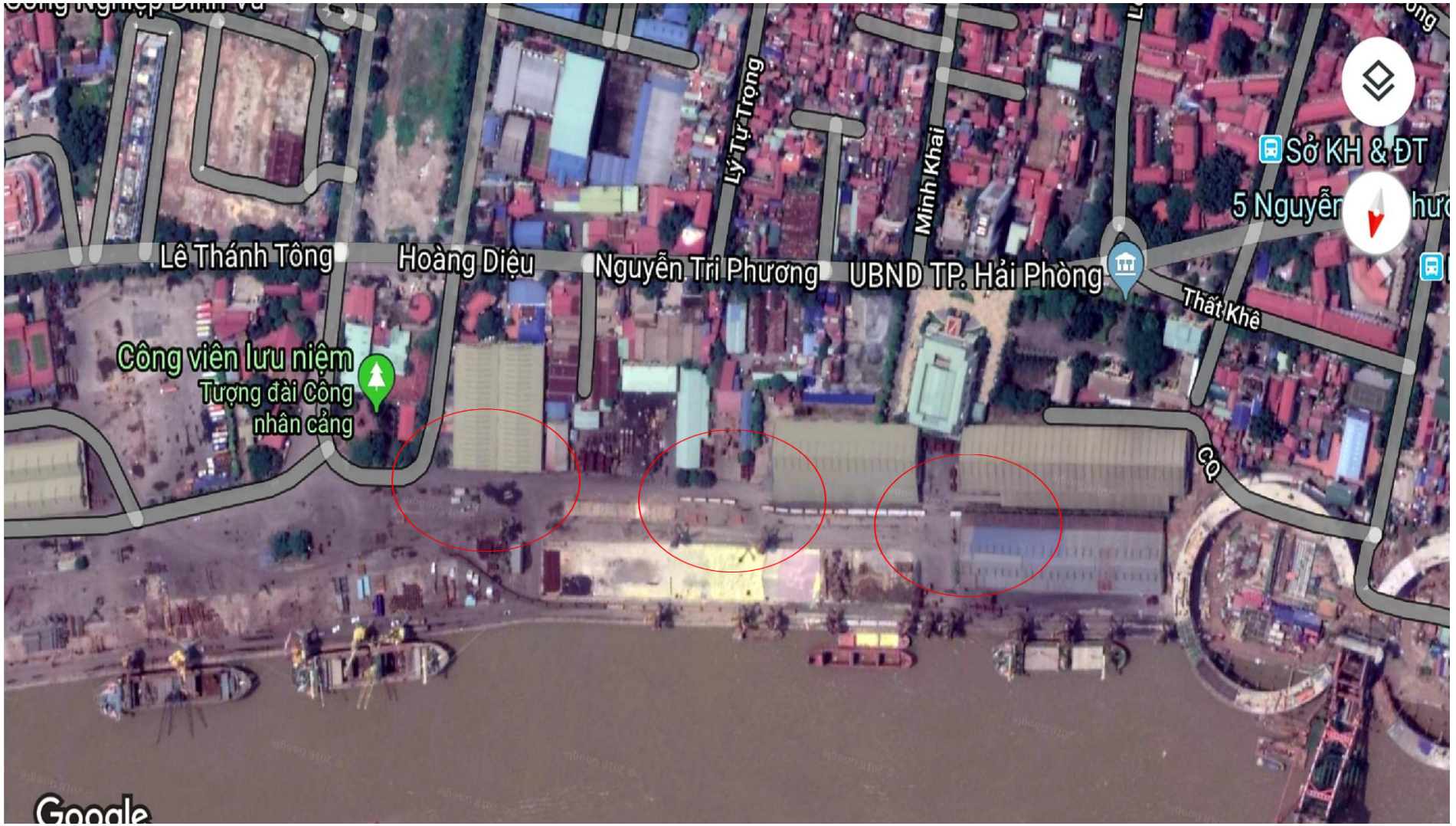


RODENT AND FLEA SURVEILLANCE

Hữu Nghị - Lạng Sơn

RODENT AND FLEA SURVEILLANCE

Hai Phong Harbour



Overview

- Goals and Objectives
- Surveillance components
- Results 2018
- Active control of vectors and hosts
- **Proposals for future studies related to rodents**

Research proposals: questions on what diseases?

Rodents-borne Diseases: Plague, Leptospira, typhus, viral hemorrhagic fever, hantavirus, parasites….

Six Dangerous Diseases Spread by Rats and Rodents

Rodents - Mice - Rats

While the pitter-patter of little feet can be a welcome sound in many a household, one can make the argument that the happiness scale is directly correlated with the type of feet attached to that sound. Namely, the species. We're talking rodents people!

Millions of homes in the United States have unwelcomed guests in the form of rats and other

1. HANTAVIRUS

Most commonly found in the white-footed mouse, cotton rat and rice rat, the **Hantavirus** is a potentially life-threatening disease that currently has no specific treatment, cure or vaccine.

Symptoms include: fever, fatigue, muscle aches (generally in hips, backs and thighs) and may include, diarrhea abdominal pain, nausea and vomiting.

FULL PAPER *Virology*

Molecular Epidemiological and Serological Studies of Hantavirus Infection in Northern Vietnam

Thua Thang TRUONG[1)], Kumiko YOSHIMATSU[2)], Koichi ARAKI[2)], Byoung-Hee LEE[2)], Ichiro NAKAMURA[3)], Rika ENDO[2)], Kenta SHIMIZU[2)], Shumpei P. YASUDA[2)], Takaaki KOMA[2)], Midori TARUISHI[2)], Megumi OKUMURA[2)], Uyen Ninh TRUONG[1)] and Jiro ARIKAWA[2)]*

[1)]National Institute of Hygiene and Epidemiology, Hanoi, Vietnam [2)]Department of Microbiology, Hokkaido University Graduate School of Medicine and [3)]Hokkaido University Research Center for Zoonosis Control, Sapporo, Japan

(Received 7 April 2009/Accepted 29 June 2009)

In conclusion, we found that SEOV is circulating in northern Vietnam, in both humans and rodents; however, the consequence of SEOV infection as a cause of HFRS remains unclear. The Vietnamese SEOV is phylogenetically distinct from SEOVs originating in other regions, suggesting that Southeast Asian SEOVs form a separate cluster. As the existence of novel hantaviruses was also suggested, **additional epidemiological and epizootiological studies** are required to clarify the variation in, and distribution of, hantaviruses in East and Southeast Asia

2. LYMPHOCYTIC CHORIOMENINGITIS VIRUS (LCMV)

Lymphocytic choriomeningitis, or LCM, is a rodent-borne viral infectious disease caused by lymphocytic choriomeningitis virus (LCMV), a member of the family *Arenaviridae,* that was initially isolated in 1933.

> Vector Borne Zoonotic Dis. 2015 Jan;15(1):65-72. doi: 10.1089/vbz.2014.1603.

Rodents and risk in the Mekong Delta of Vietnam: seroprevalence of selected zoonotic viruses in rodents and humans

Nguyen Van Cuong [1], Juan Carrique-Mas, Hien Vo Be, Nguyen Ngoc An, Ngo Tri Tue, Nguyet Lam Anh, Pham Hong Anh, Nguyen The Phuc, Stephen Baker, Liina Voutilainen, Anne Jääskeläinen, Eili Huhtamo, Mira Utriainen, Tarja Sironen, Antti Vaheri, Heikki Henttonen, Olli Vapalahti, Yannick Chaval, Serge Morand, Juliet E Bryant

Affiliations + expand

PMID: 25629782 PMCID: PMC4676424 DOI: 10.1089/vbz.2014.1603

Free PMC article

Abstract

In the Mekong Delta in southern Vietnam, rats are commonly traded in wet markets and sold live for food consumption. We investigated seroprevalence to selected groups of rodent-borne viruses among human populations with high levels of animal exposure and among co-located rodent populations. The indirect fluorescence antibody test (IFAT) was used to determine seropositivity to

Very little seroreactivity was observed to LCMV in either rodents (1/275, 0.4%) or humans (2/245, 0.8%). Molecular screening of rodent liver tissues using consensus primers for flaviviruses did not yield any amplicons, whereas molecular screening of rodent lung tissues for hantavirus yielded one hantavirus sequence (SEOV). In summary, these results indicate low to moderate levels of endemic hantavirus circulation, possible circulation of a flavivirus in rodent reservoirs, and the first available data on human exposures to parechoviruses in Vietnam. Although the current evidence suggests only limited exposure of humans to known rodent-borne diseases, further research is warranted to assess public health implications of the rodent trade.

3. PLAGUE

95 results

Page 1 of 10

1. **Plague** in **Vietnam**.
[No authors listed]
Lancet. 1968 Apr 13;1(7546):799-800.
PMID: 4171138 No abstract available.
Cite
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2. **Plague** in **Vietnam**.
[No authors listed]
Br Med J. 1968 Apr 6;2(5596):4.
PMID: 20791484 **Free PMC article.** No abstract available.
Cite
Share

3. **Plague** in **Vietnam** 1965-1966.
Marshall JD Jr, Joy RJ, Ai NV, Quy DV, Stockard JL, Gibson FL.
Am J Epidemiol. 1967 Nov;86(3):603-16. doi: 10.1093/oxfordjournals.aje.a120770.
PMID: 6081384 No abstract available.
Cite
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4. [The **plague** in **Vietnam**: history and inventory of collected fleas (insecta, Siphonaptera) in the inhabited zones].
Beaucournu JC, Sountsova NI, Ly TV, Sountsov VV.
Cite

Future study for Plague host/vector

Data need to collect:

- Temperature,
- duration of sunshine,
- rainfall and humidity
- Mapping areas

were recorded as monthly averages by local meteorological stations.

4. SALMONELLA

Salmonella are bacteria that can live in the intestinal tract of many different animals. *Salmonella* can make both people and animals sick.

- Many animals and pets can carry these germs, even if they look clean and healthy. Animals that can spread *Salmonella* to people include
  - Poultry (chicks, chickens, ducklings, ducks, geese, and turkeys)
  - Other birds (wild birds)
  - Reptiles (turtles, lizards, and snakes)
  - Amphibians (frogs and toads)
  - **Rodents (mice, rats, hamsters, and guinea pigs)**
  - Other small mammals (hedgehogs)
  - Farm animals (goats, calves, cows, sheep, and pigs)

Symptoms: chills, fever, abdominal cramps, nausea, vomiting, and diarrhea.

5. TULAREMIA

Caused by the bacterium Francisella tularenis, **Tularemia** is often found in rodents, rabbits and hares who are especially prone. Tularemia is most commonly transferred to humans by an **infected tick or deer fly bite**, or by handling of an animal that is infected. Reported in almost every state in America, Tularemia can be life a threatening illness, though most cases can be treated with the use of antibiotics.

6. LayV fever

The Hendra virus and Nipah virus

Recently, 35 febrile human cases in two provinces in China were investigated and confirmed due to other henipavirus infection called Langya henipavirus (LayV) [1].

LayV is most phylogenically related to Mojiang henipavirus which were detected in Southern China [2].

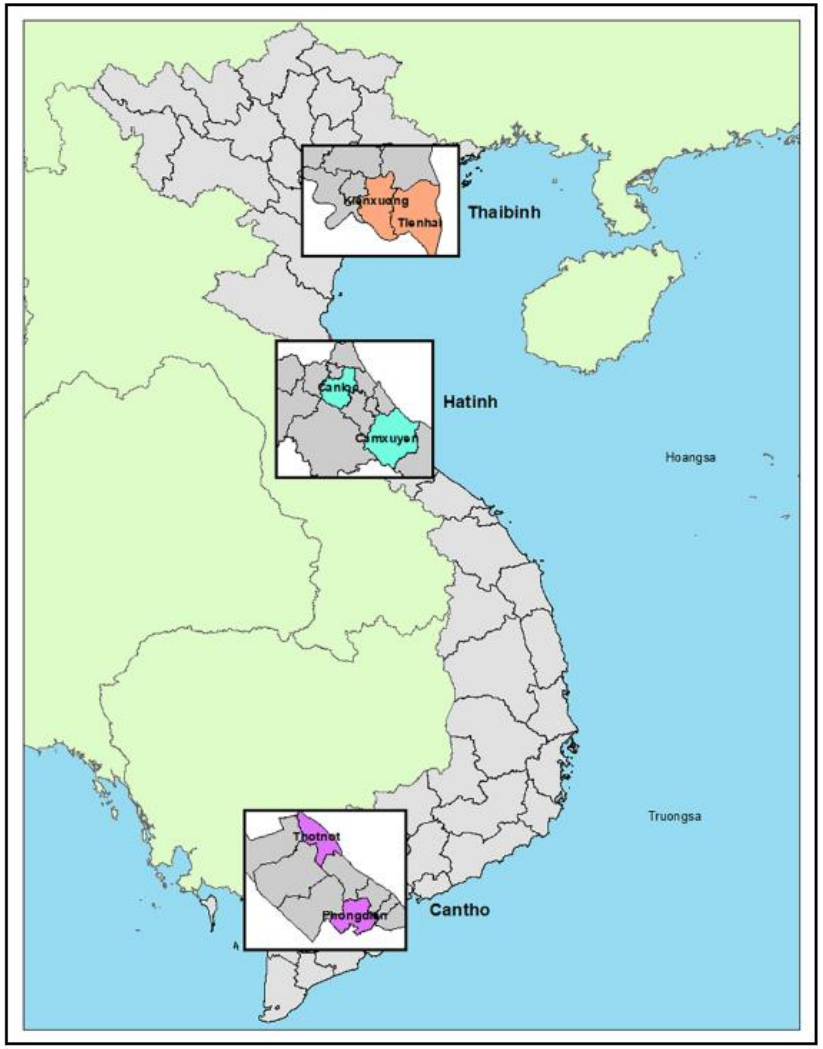
Natural host: Shews

7. Leptospira

A high seropositive proportion with 17 different serovars was detected in all studied animals, which indicates the diversity of Leptospira in Vietnam.

14% seropositive in rats

This study showed **a high prevalence of Leptospira circulating in both domestic and wild animals**, increasing the risk of pathogenic leptospires transmission to humans in Vietnam.



Research proposals

Geospatial approaches for monitor hosts and human cases

Spatial epidemiology+ vulnerability areas+ disease ecology

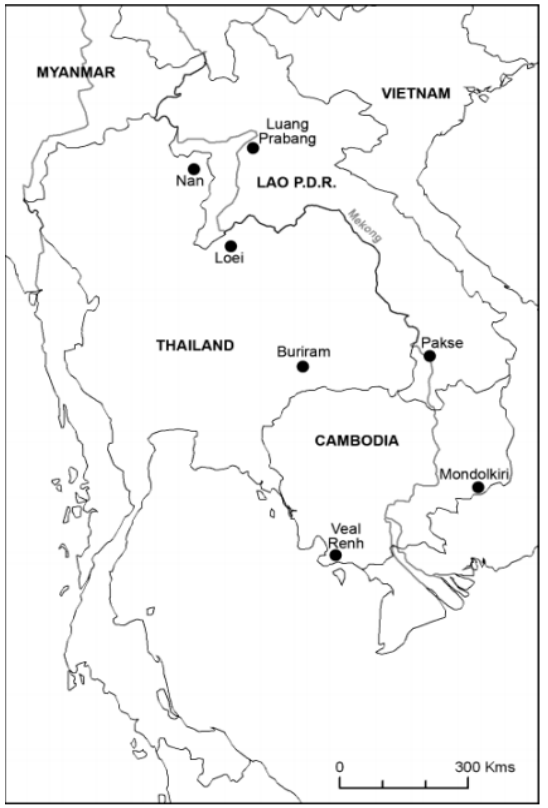


Figure 1: Location of the seven CERoPath sampling sites in South-East Asia

Concept note 1:

Seroprevalence study of LayV virus (henipavirus) amongst dog, goat, rodent and febrile human in the northern provinces of Vietnam at PoE areas bodering with China

Concept note 2:

Detection of *Leptospira* in hosts and environment in the northern provinces of Vietnam bordering with China and Laos

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(source: Kobotoolbox)

Thank you!