"Severe Fever with Thrombocytopenia Syndrome (SFTS)"

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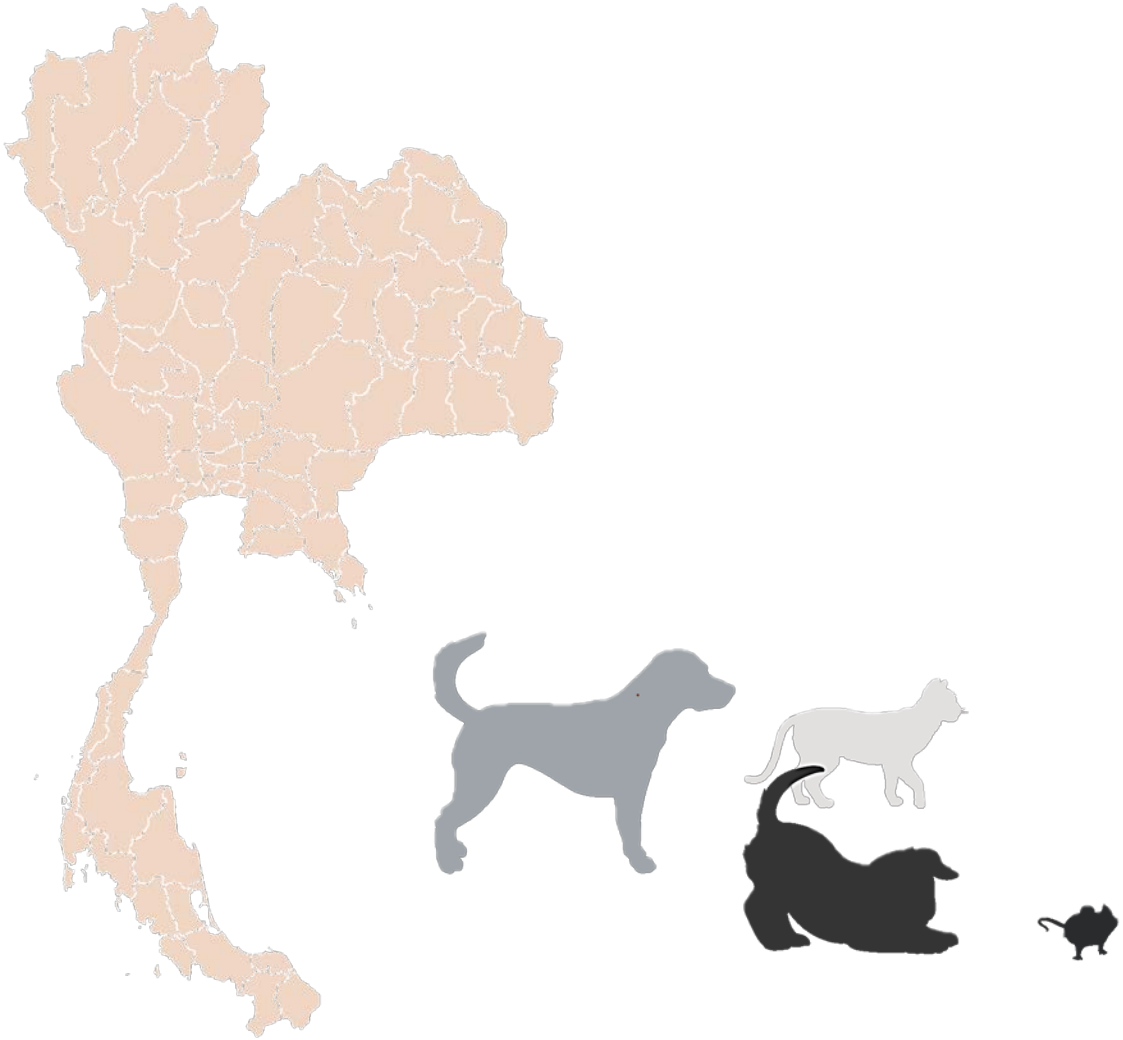
Emerging SFTSV Threat in Thailand: Human Infections, Animal Reservoirs, and Vector Ecology



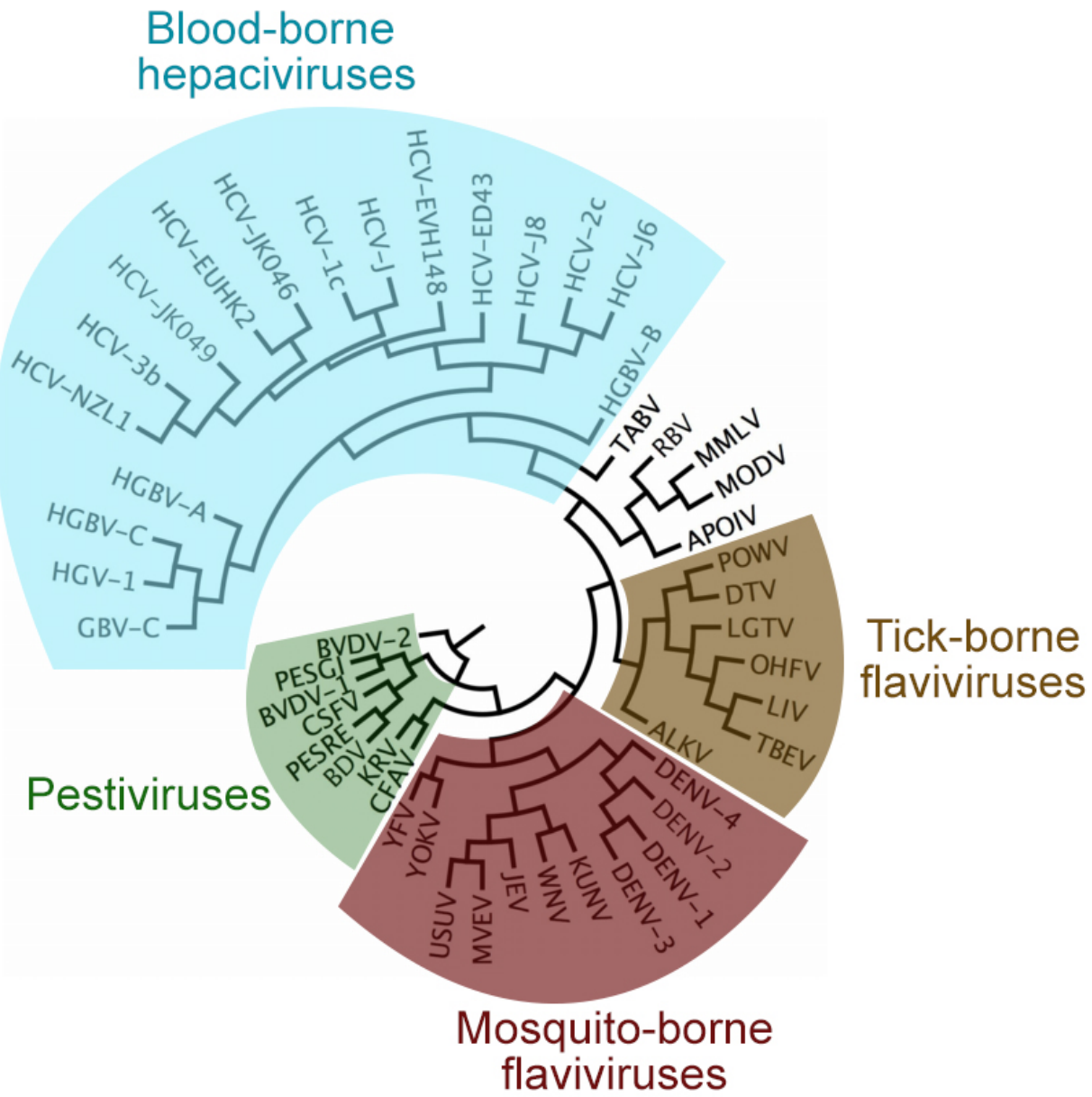
Arthropod-borne viruses (Arboviruses)

- Existed throughout human history
- Causes of human and animal diseases
- Emergence of arbovirus infections
  - international trade & transportation, migration, climate change, difficulties with treatment, vaccine development, vector control etc.

Arthropod-borne viruses (Arboviruses)

Human pathogens:

- Dengue Virus
- West Nile virus
- Yellow fever
- Japanese encephalitis virus
- Chikungunya Virus
- Zika virus
- Oropouche virus
- Mayaro virus
- SFTSV (Dabie bandavirus)



Phylogenetic analysis of Flaviviridae family

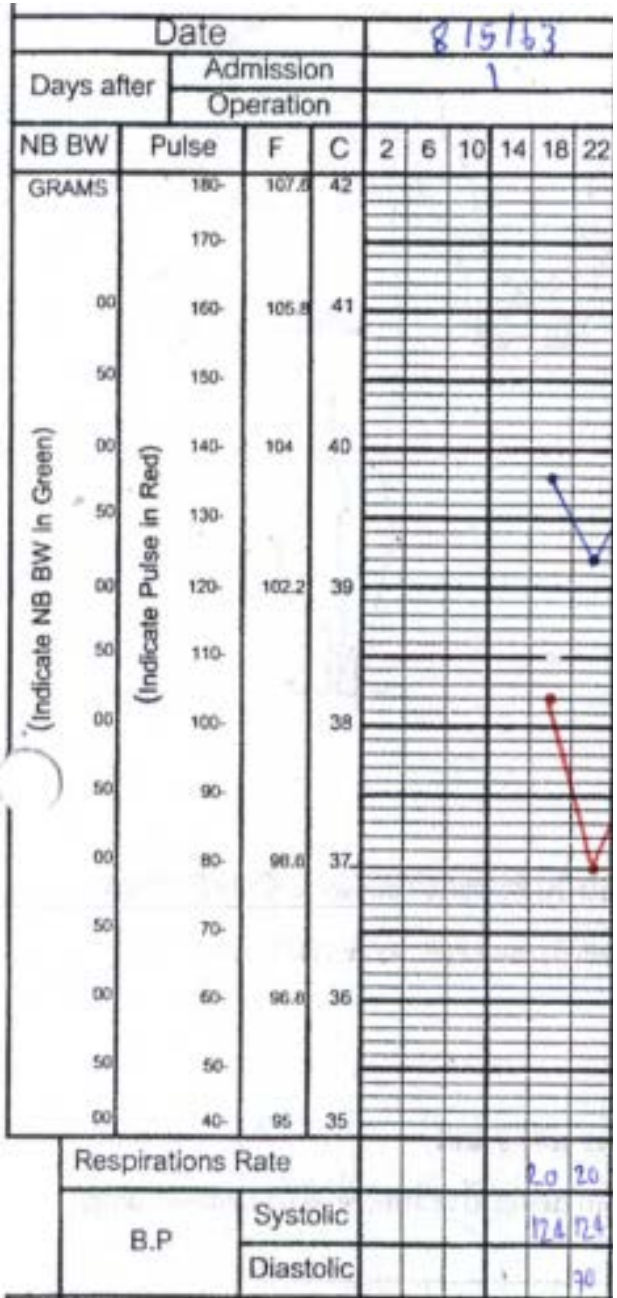
http://www.utmb.edu/discoveringdenguedrugs-together/Diseases/Flaviviridae%20Family.asp

วัยรุ่นชาย อายุ 16 ปี อยู่อำเภอเมือง (บ้านสวน) ชลบุรี นักเรียนร่างกายแข็งแรงดี

- ไข้สูงมา 3 วัน ตรวจร่างกาย คลำตับได้ อย่างอื่นไม่พบอะไรผิดปกติ
- ตรวจ CBC Hb 14.9 gm%, Hct 44% WBC 2500 /cumm Platelets 92,000 N71% L18% M8%
- Repeated the day after Platelets 172,000/cumm
- BUN, Cr normal, LFT mild elevation AST, ALT

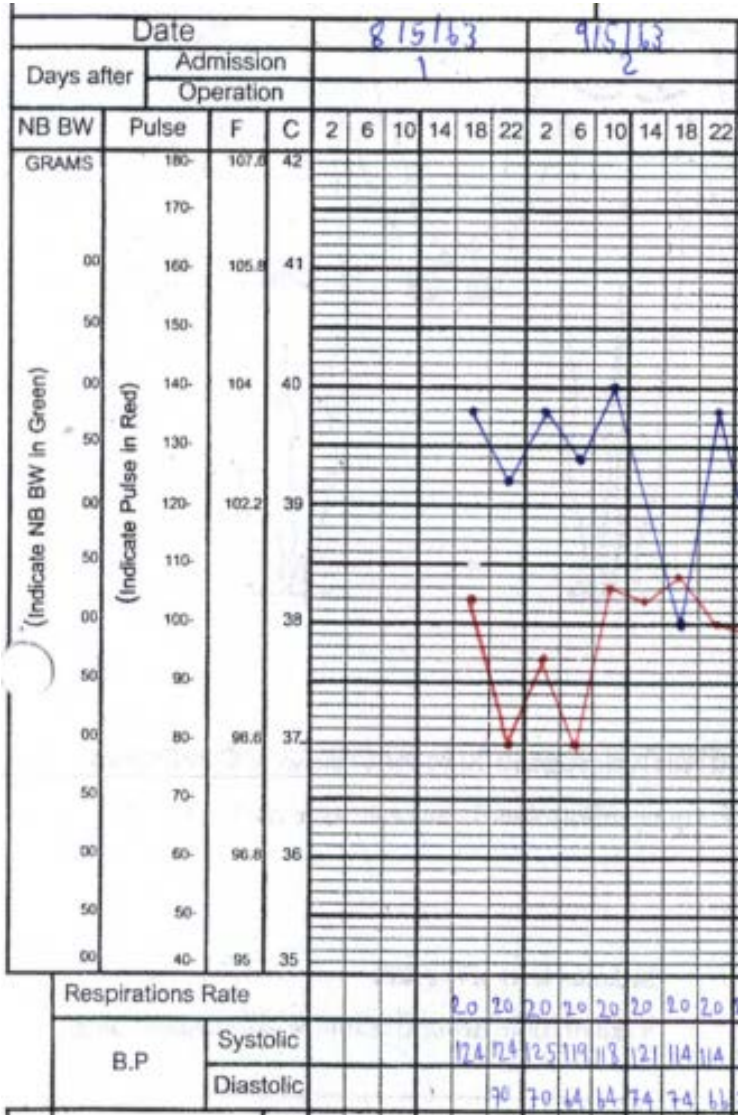
Case 3

Day 4


Date
8/5/63
Days after
Admission
Operation
1
NB BW
Pulse
F
C
2
6
10
14
18
22
GRAMS
(Indicate NB BW in Green)
(Indicate Pulse in Red)
180-
170-
160-
150-
140-
130-
120-
110-
100-
90-
80-
70-
60-
50-
40-
107.6
105.8
104
102.2
98.6
96.6
95
42
41
40
39
38
37
36
35
Respirations Rate
20
20
B.P
Systolic
124
124
Diastolic
90

Case 3

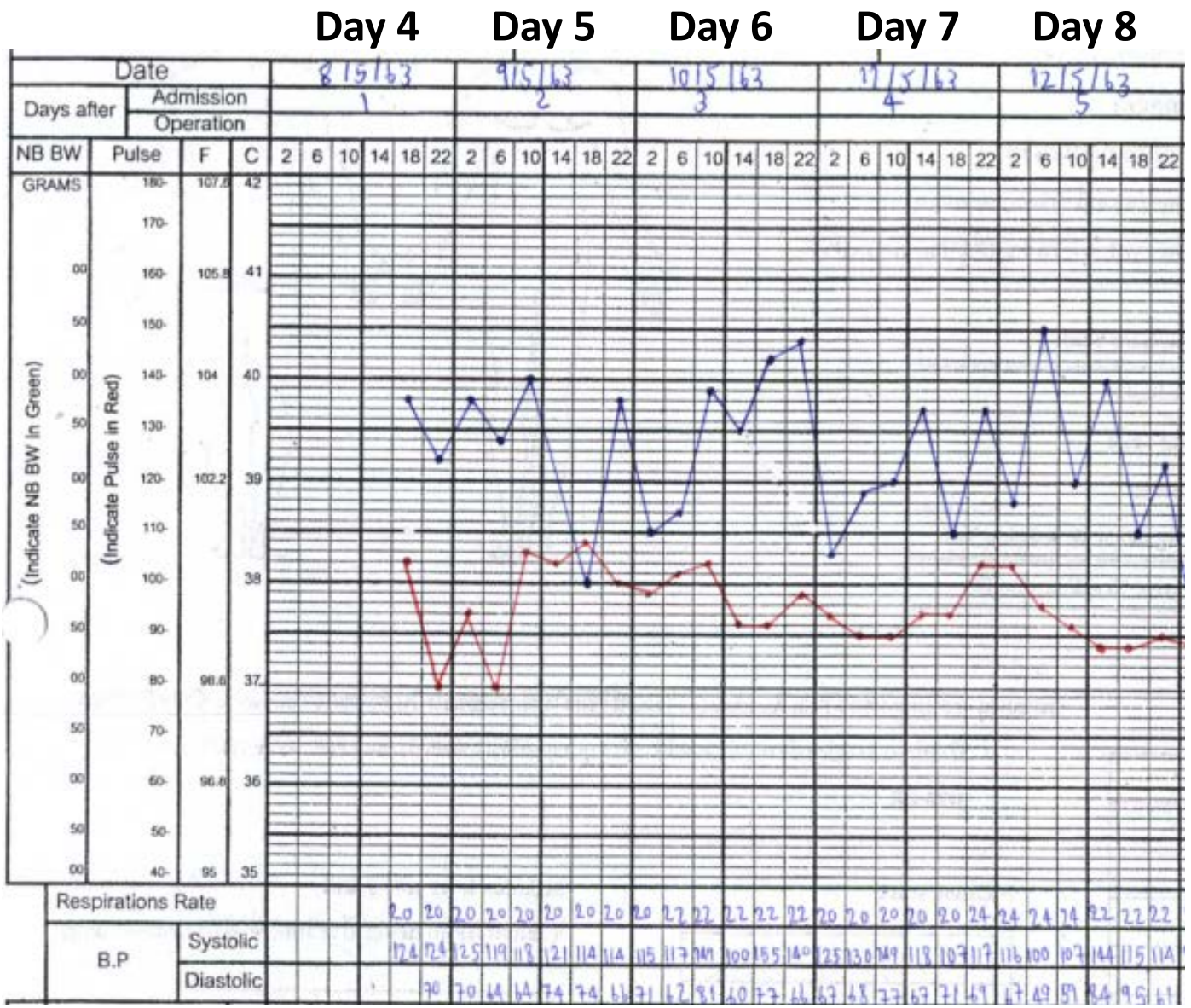
Day 4 **Day 5**



Repeated CBC

- Hb 14.7 gm Hct 44%
- WBC 2300 cumm
- Platelets 130,000 cumm

Case 3


Day 4
Day 5
Day 6
Day 7
Day 8
Date
8/5/63
9/5/63
10/5/63
11/5/63
12/5/63
Days after
Admission
Operation
1
2
3
4
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NB BW
Pulse
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C
2 6 10 14 18 22
GRAMS
(Indicate NB BW in Green)
(Indicate Pulse in Red)
180-
170-
160-
150-
140-
130-
120-
110-
100-
90-
80-
70-
60-
50-
40-
107.6
105.8
104
102.2
98.6
96.8
95
42
41
40
39
38
37
36
35
Respirations Rate
B.P
Systolic
Diastolic

Lab investigation

Flu A/B negative, Covid-19 neg

Dengue NS1 neg

EBV IgM neg, VZV neg

Consult ID

* Chikungunya IgG, IgM. neg, RT-PCR neg.
  UA negative
* Hemo culture x3D no growth x 2 ขวด
* Scrup typhus IgM negative
* Stool c/s for enteropathogenic bacteria neg
* Ultrasound hepatomegaly 15.7 cm

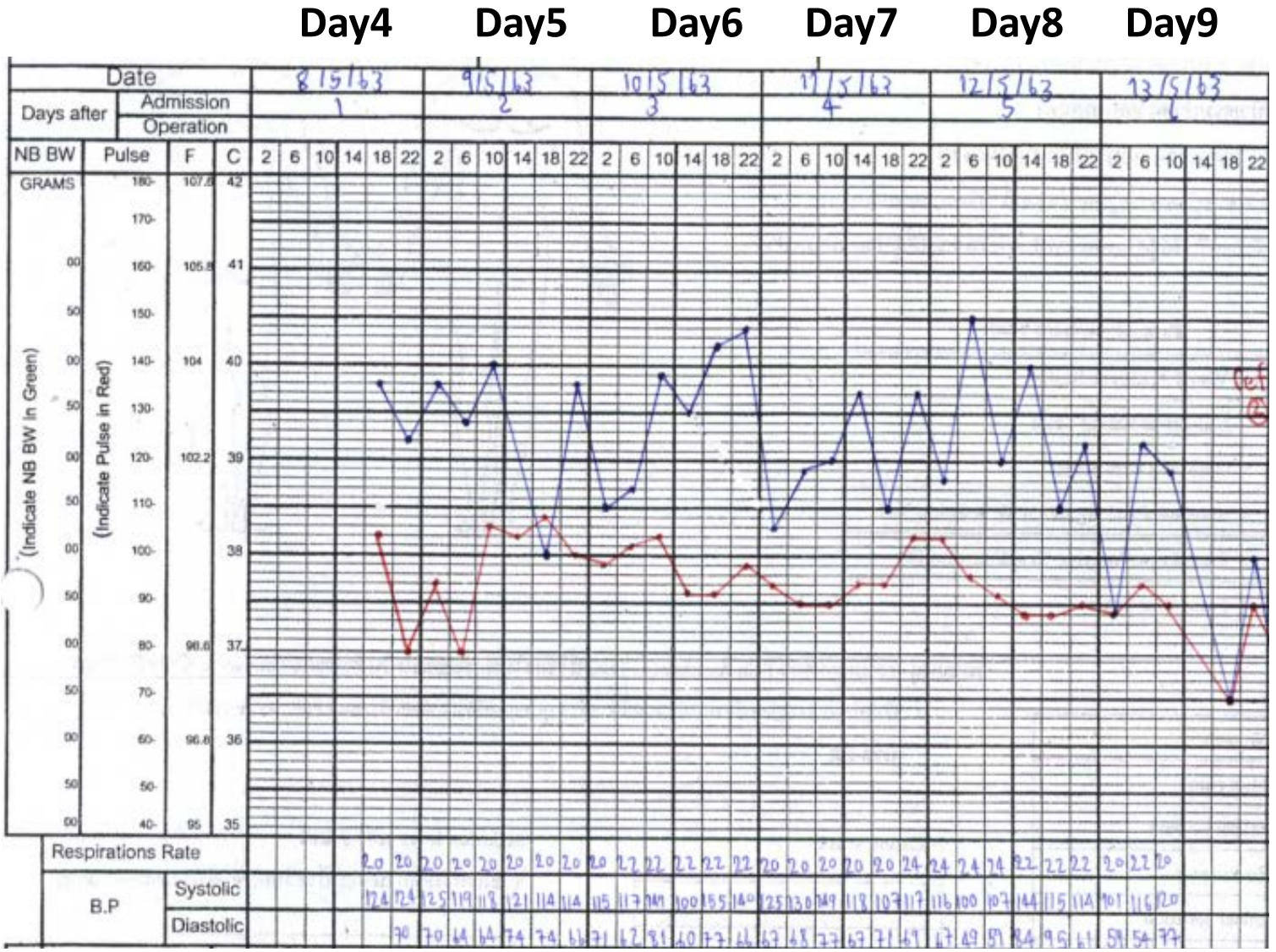
Repeated CBC

Hb 14.5 gm Hct 44.3%

WBC 1000 cumm

Platelets 78,000 cumm

Case 3

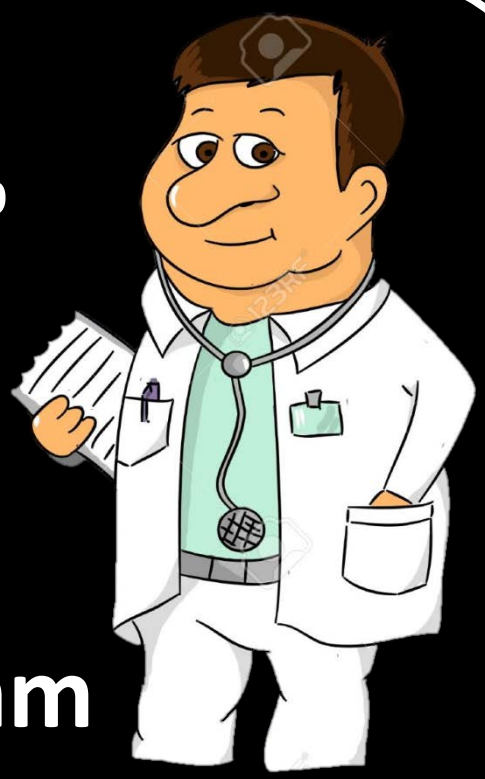

Day4
Day5
Day6
Day7
Day8
Day9
Date
Days after
Admission
Operation
NB BW
Pulse
F
C
GRAMS
(Indicate NB BW in Green)
(Indicate Pulse in Red)
Respirations Rate
B.P
Systolic
Diastolic

Repeated CBC

Hb 15.9 gm Hct 47.9%

WBC 5400 cumm

Platelets 68,000 cumm



Suspect hemophagocytic syndrome

Consult Hemato

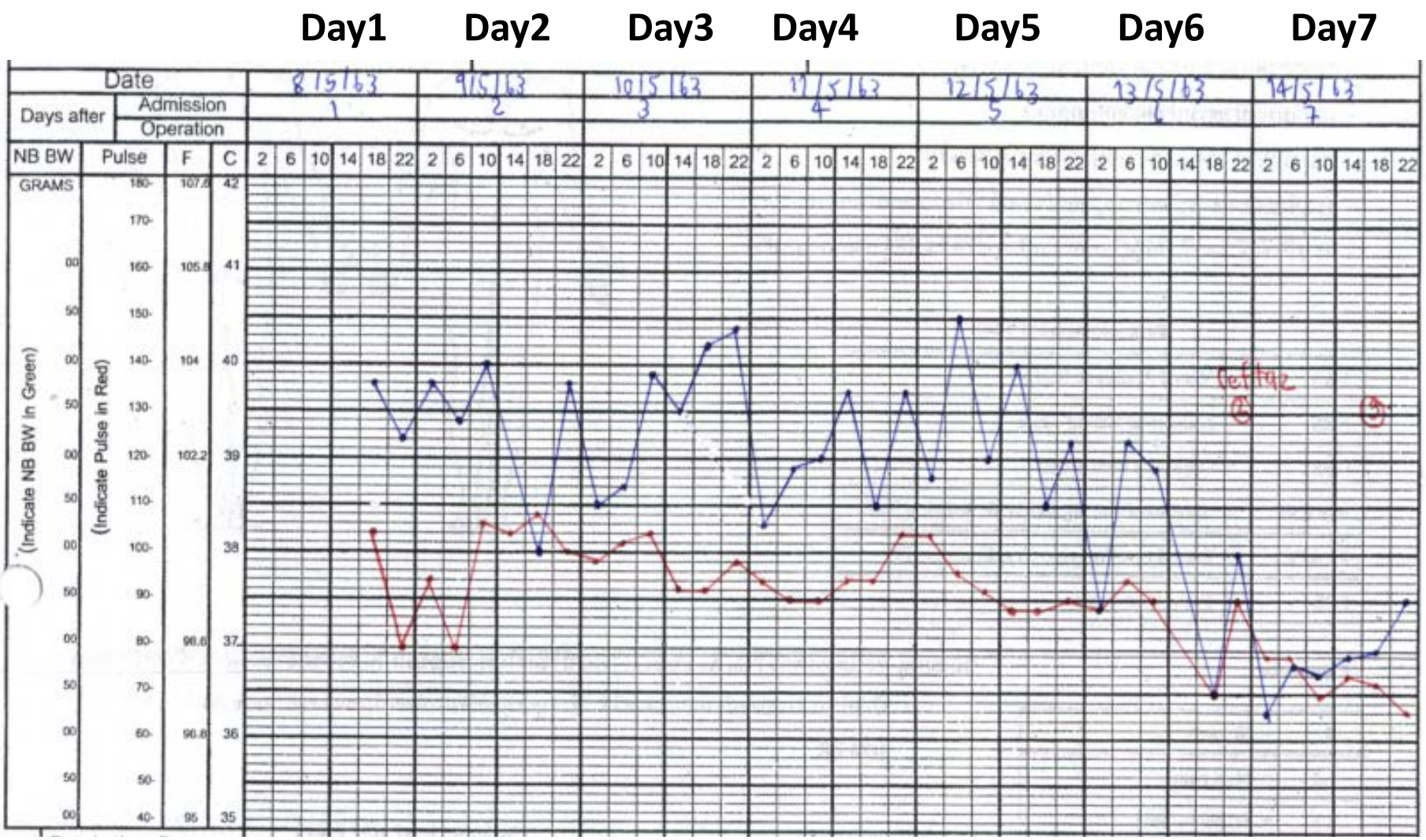
Repeated CBC

Hb 15.0 gm Hct 47.9%

WBC 5400 cumm

Platelets 68,000 cumm

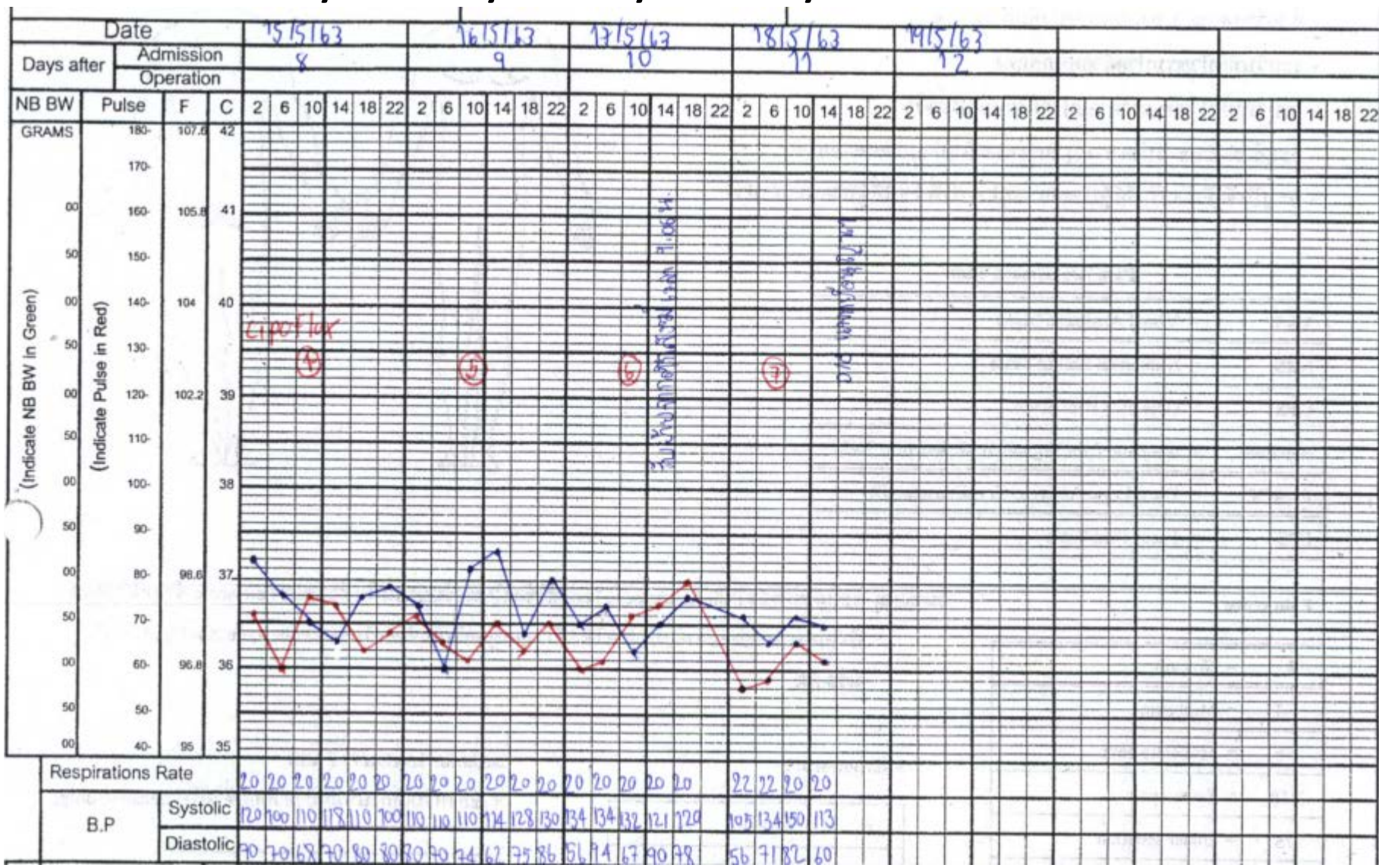
Case 3


Day1
Day2
Day3
Day4
Day5
Day6
Day7
Date
Days after
Admission
Operation
8/5/63
9/5/63
10/5/63
11/5/63
12/5/63
13/5/63
14/5/63
NB BW
Pulse
F
C
GRAMS
(Indicate NB BW in Green)
(Indicate Pulse in Red)
107.6
105.8
104
102.2
98.6
96.8
95
42
41
40
39
38
37
36
35
Coffee

ไข้ลง หลังให้ยาปฏิชีวนะหลายตัว

น่าจะ consult อ. ยง มีตับโต จาก ultrasound

Case 3


Day8
Day9
Day10
Day11
Date
Days after
Admission
Operation
15/5/63
16/5/63
17/5/63
18/5/63
19/5/63
8
9
10
11
12
NB BW
Pulse
F
C
GRAMS
(Indicate NB BW in Green)
(Indicate Pulse in Red)
Respirations Rate
B.P
Systolic
Diastolic

Severe Fever with Thrombocytopenia Syndrome Virus, Thailand.

Case Report

Severe Fever with Thrombocytopenia Syndrome Virus: The First Case Report in Thailand

Supitcha Ongkittikul, MD[1] ; Ruedeerat Watanawong, MD[2] ; Photchana Rompho, RN[3]

- Patient: 70-year-old Thai woman
- Begins with fever and nonspecific prodromal symptoms
- Progresses to encephalitis and multi-organ failure
- Laboratory Findings:
  WBC: 2,100/mm³ (45% neutrophils, 50% lymphocytes)
  Platelet: 88,000/mm³
  D-dimer: 2.96 µg/mL → Coagulopathy/DIC
  Peripheral smear: ↓ platelets, few schistocytes, polychromasia
  Liver enzymes: AST 814, ALT 142 IU/L
  CPK: 1,336 U/L
  LDH: 2,407 U/L
  Dengue PCR and IgM: Negative
  Specimens collected for rabies testing (saliva, serum, hairline, urine, CSF) → All results negative
  Serum PCR detected SFTSV RNA → Confirmed diagnosis of Severe Fever with Thrombocytopenia Syndrome
- Upon further history taking, it was revealed that:
  Her seven pet cats had fallen ill and died within one week, one month before her symptoms.

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EID Journal > Volume 28 > Number 12—December 2022 > Main Article

Volume 28, Number 12—December 2022

Research Letter

Severe Fever with Thrombocytopenia Syndrome Virus Infection, Thailand, 2019–2020

Patthaya Rattanakomol, Sarawut Khongwichit, Piyada Linsuwanon, Keun Hwa Lee, Sompong Vongpunsawad, and Yong Poovorawan✉
Author affiliations: Chulalongkorn University, Bangkok, Thailand (P. Rattanakomol, S. Khongwichit, S. Vongpunsawad, Y. Poovorawan); US Army Medical Directorate–Armed Forces Research Institute of Medical Sciences, Bangkok, Thailand (P. Linsuwanon); Hanyang University, Seoul, South Korea (K.H. Lee)

Cite This Article

Abstract

Infection with severe fever with thrombocytopenia syndrome (SFTS) virus, which can cause hemorrhagic febrile illness, is often transmitted by ticks. We identified 3 patients with SFTS in or near Bangkok, Thailand. Our results underscore a need for heightened awareness by clinicians of possible SFTS virus, even in urban centers.

Severe fever with thrombocytopenia syndrome (SFTS) is a tickborne viral disease associated with acute fever, possibly accompanied by vomiting, diarrhea, fatigue, myalgia, and leukocytopenia (*1*). Most reports of infection have come from studies in South Korea, Japan, and China, although Taiwan, Vietnam, and Myanmar have had confirmed cases in recent years (*2*). Severe infections can cause hemorrhagic fever and multiple organ failure leading to death. SFTS results from infection by the SFTS virus (SFTSV, newly renamed *Dabie bandavirus*), an RNA virus in the family Phenuiviridae, genus *Bandavirus* (*3*). More frequent arbovirus infections in Thailand, primarily dengue and chikungunya, often confound diagnosis of febrile illness caused by other viruses such as SFTSV because most clinicians lack awareness.

Archives of Virology (2023) 168:271
https://doi.org/10.1007/s00705-023-05897-1

ANNOTATED SEQUENCE RECORD

Check for updates

Severe fever with thrombocytopenia syndrome virus genotype B in Thailand

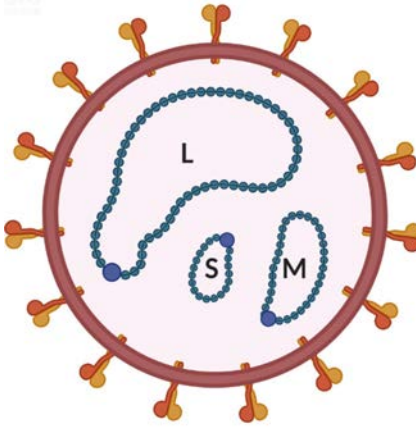
Patthaya Rattanakomol[1] · Sarawut Khongwichit[1] · Watchaporn Chuchaona[1] · Sompong Vongpunsawad[1] · Yong Poovorawan[1]

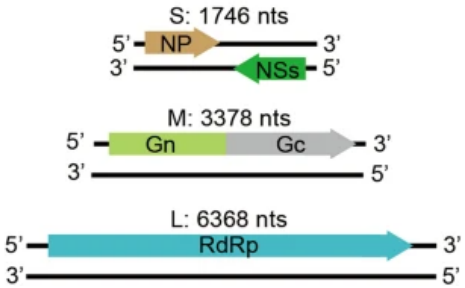
Received: 8 May 2023 / Accepted: 20 August 2023 / Published online: 13 October 2023

Abstract

Severe fever with thrombocytopenia syndrome virus (SFTSV) has been reported in many countries in Southeast Asia, which expands the original geographic range of China, Korea, and Japan. Here, we report the complete genome sequences of two Thai SFTSV strains previously identified in patients with undifferentiated febrile illness in 2020. Phylogenetically, both clustered with SFTSV genotype B strains and were most closely related to those previously reported in central China (≥99.0% nucleotide sequence identity) in the L, M, and S gene segments. Nine amino acid residues encoded by one or more Thai SFTSV genomes differed from those found in global strains. Interestingly, the observed differences in numerous residues between the Thai strains suggest possible separate introductions of different variants into the region.

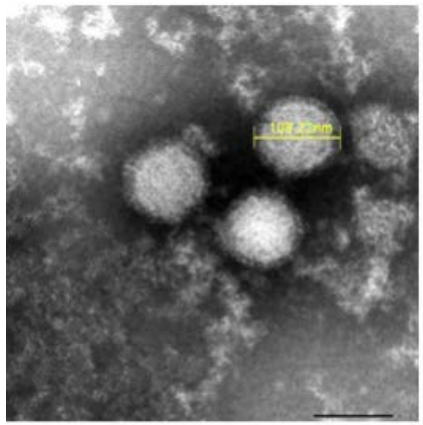
Severe Fever with Thrombocytopenia Syndrome Virus (SFTSV)





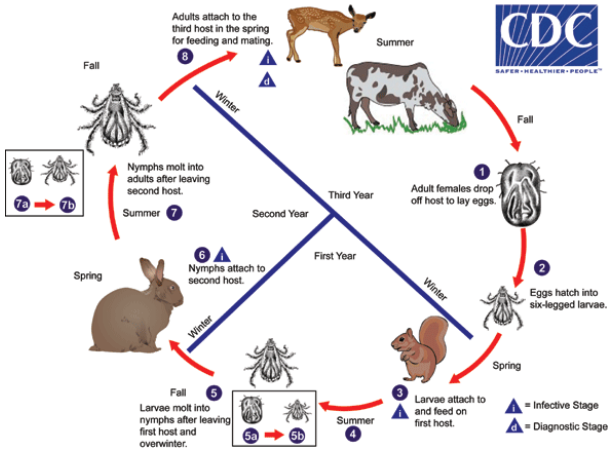
https://doi.org/10.1186/s12985-023-02033-y

Enveloped, negative-sense, single-stranded, three-genomic segmented, RNA virus
Order: Bunyavirales (formerly the Bunyaviridae family)
Family: Phenuiviridae
Genus: Bandavirus
Renamed as Dabie bandavirus
Potential vectors: ticks (Haemaphysalis longicornis, Amblyomma testudinarium, Ixodes nipponesis, and Rhipicephalus microplus)



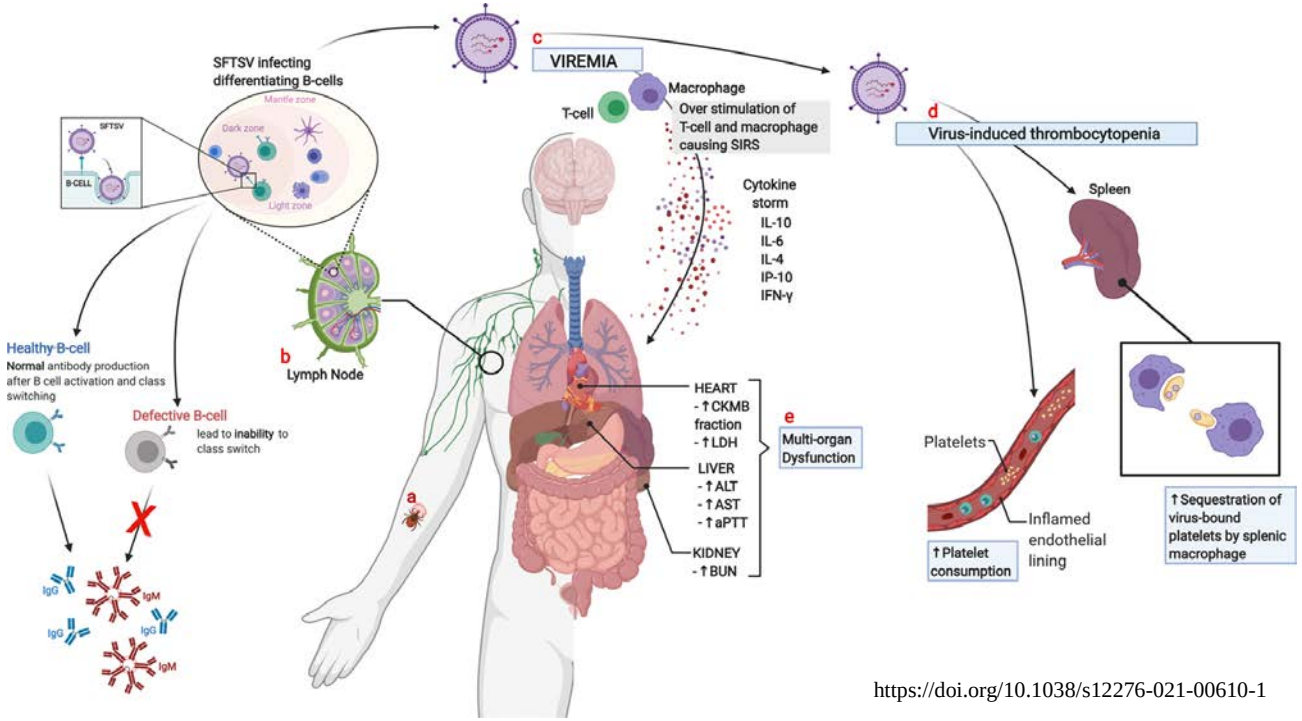
IASR

Three-Host Ixodid Tick Life Cycle



Severe Fever with Thrombocytopenia Syndrome (SFTS)

a tick-borne viral disease, caused by SFTSV, associated with acute fever, which may accompany vomiting, diarrhea, fatigue, myalgia, rash, and leukocytopenia



https://doi.org/10.1038/s12276-021-00610-1

Clinical disease course

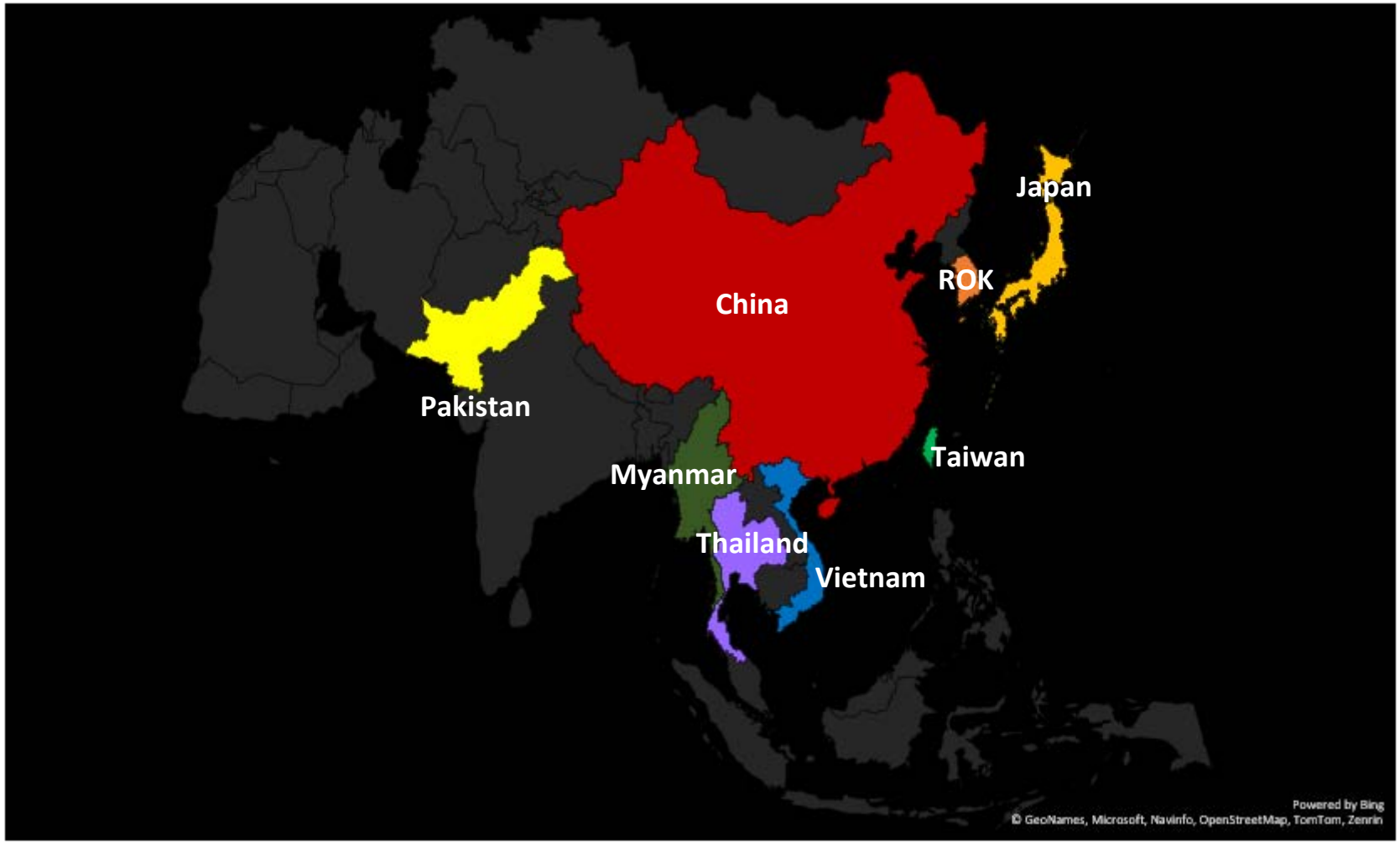
1. Incubation: 5 to 14 days since tick bites - onset
2. Fever: 1 to 7 days -- fever, headache, and GI symptoms

When virus load↑

- Progressive PLT and WBC ↓
- Serum biochemistry parameters; ALT, AST, LDH, BUN and CPK ↑

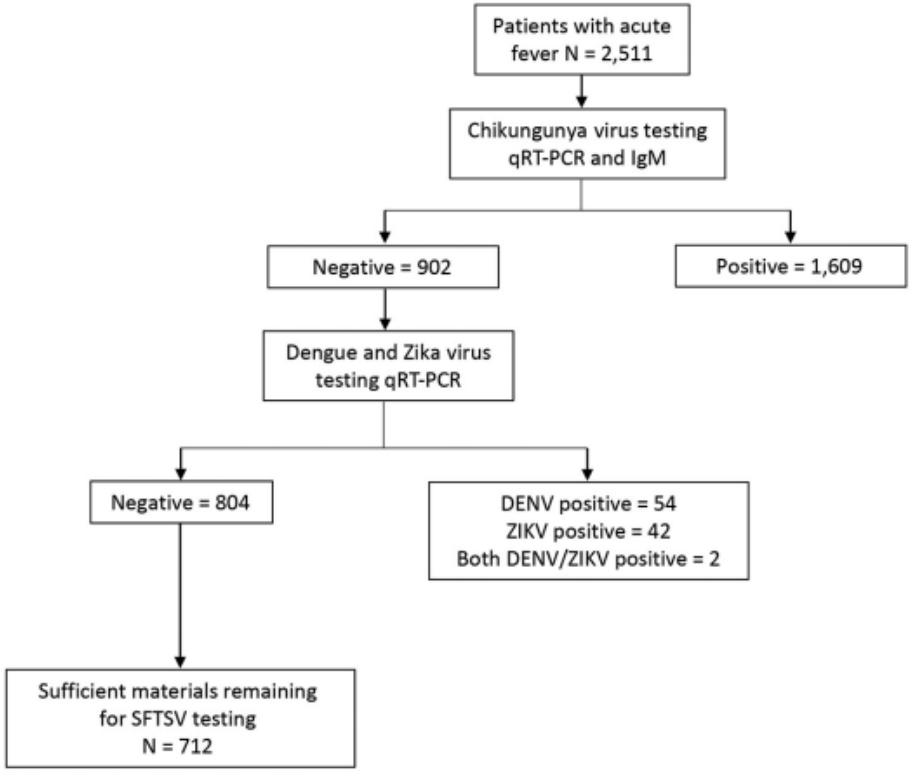
3. Multiple organ failure
4. Convalescence

SFTSV infection has increased rapidly in both incidence and geographical range since 2009



Most frequent arbovirus infections in Thailand, primarily dengue and chikungunya, often confound febrile illness caused by other virus infections

- At the end of 2018, an upsurge of chikungunya virus (CHIKV) infection in Thailand found that >70% of acute febrile illnesses were laboratory-confirmed CHIKV (Khongwichit S *et al.*, 2021).
- The eventual decreasing proportion of CHIKV-positive samples led to screening for other viral etiologies of acute fever including dengue and Zika.
- At the time, SFTSV was reported in Vietnam.
- Therefore, samples tested negative for all three viruses were examined for possible SFTSV infection.



Appendix Figure. Febrile illness samples chosen for SFTSV testing

P. Rattanakomol *et al.*, 2022

A possible SFTSV in urban centers

Table. Detection of SFTSV in Thai patients, 2019-2020.

	Patient 1	Patient 2	Patient 3
Information			
Age and gender Location Collection date	60, male Bangkok 14 Nov 2019	16, male Chachoengsao 10 May 2020	52, female Bangkok 19 Oct 2020
Clinical manifestations			
Temperature and symptoms	37.2 °C Myalgia, arthralgia, cough, nausea, vomiting, abdominal pain, diarrhea	40.6 °C Myalgia	38.1 °C Myalgia Arthralgia
Laboratory findings (most extreme)			
White blood cells (4,100-10,900 cells/μL)	1,790	900	2,770
Neutrophil (40-72 %)	45	31	121,000
Lymphocyte (18-49 %)	42	59	62
Platelet (140,000-400,000 cells/μL)	107,000	45,000	34
Aspartate aminotransferase (<40 U/L)	Not done	102	1,758
Alanine aminotransferase (<41 U/L)	24	63	973
Pathogens not detected			
Rickettsia/Orientia spp. and	Influenza A/B	Influenza A/B, Epstein-Barr, Hepatitis B/C, SARS-CoV-2, Malaria, Leptospira, Burkholderia pseudomalle	Hepatitis A/B

Archives of Virology (2023) 168:271
https://doi.org/10.1007/s00705-023-05897-1

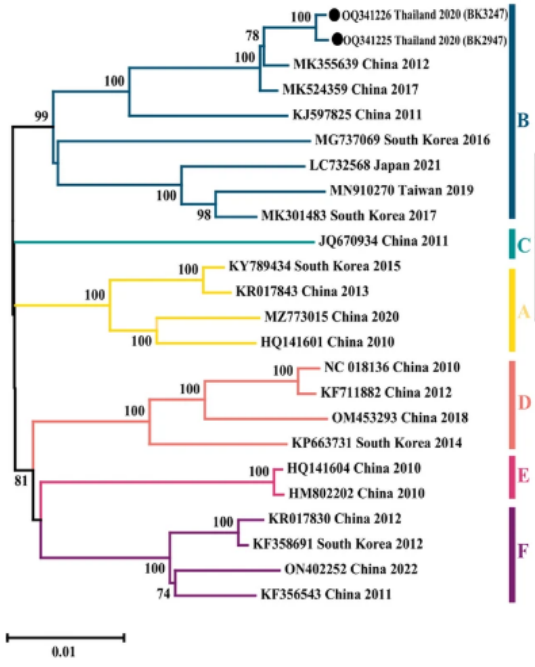
ANNOTATED SEQUENCE RECORD

Severe fever with thrombocytopenia syndrome virus genotype B in Thailand

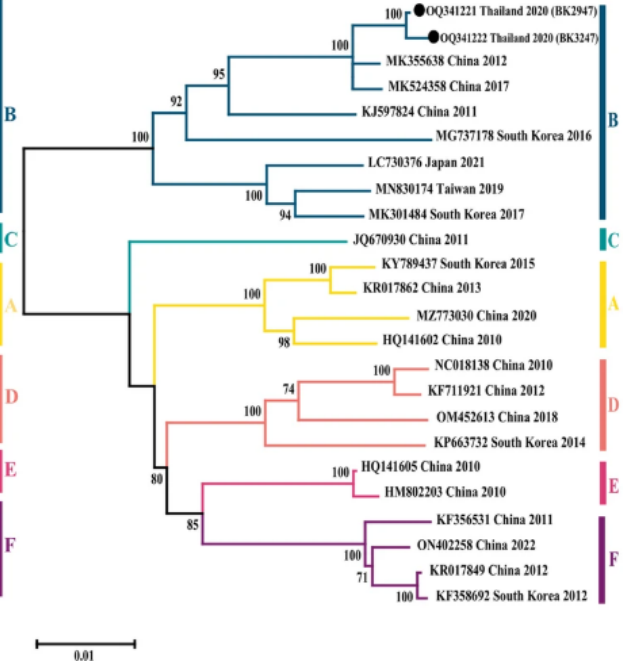
Patthaya Rattanakomol[1] · Sarawut Khongwichit[1] · Watchaporn Chuchaona[1] · Sompong Vongpunsawad[1] · Yong Poovorawan[1]

Phylogenetic analysis of the SFTSV strains in Thailand

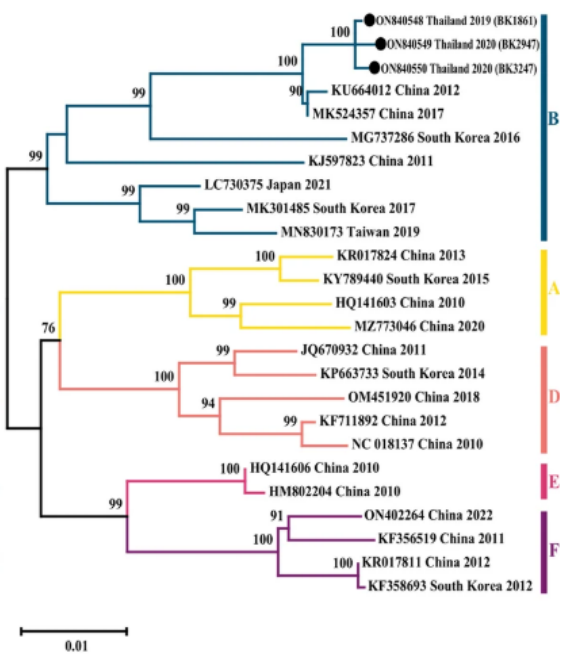
L segment (6,246 nt)



M segment (3,214 nt)



S segment (1,674 nt)



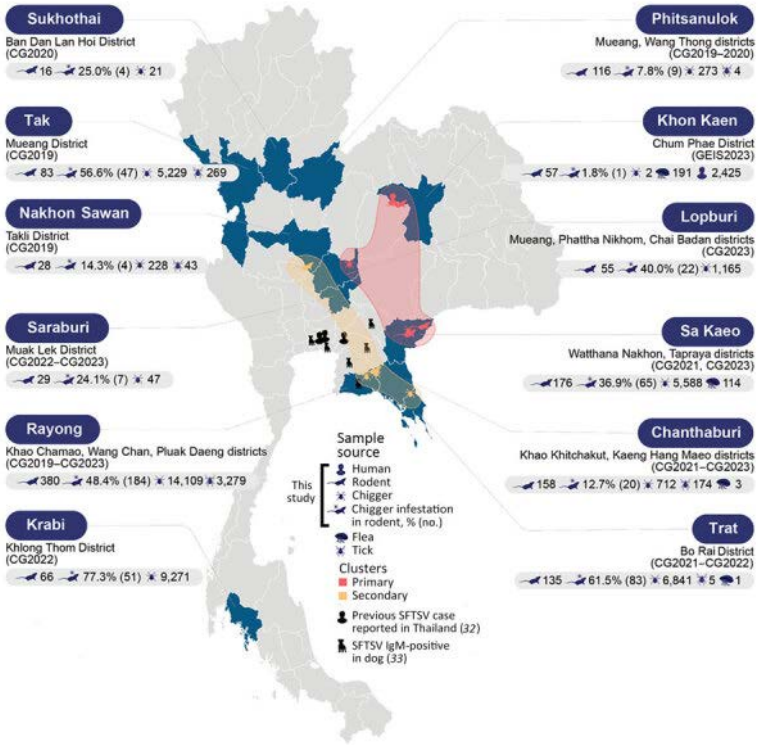
Phylogenetic analysis of the S, M, and L segments confirmed that Thai strains clustered together and were most closely related to previously reported Chinese strains.

EMERGING INFECTIOUS DISEASES

Emerg Infect Dis. 2024 Nov;30(Suppl 2):S111–S119. doi: 10.3201/eid3014.240163

Comprehensive Surveillance of Severe Fever with Thrombocytopenia Syndrome Virus in Patients with Acute Febrile Illness, Wild Rodents, and Trombiculid Larval Mites, Thailand

Piyada Linsuwanon[1,2], Yong Poovorawan[1], Keun Hwa Lee[1], Nutthanun Auysawasdi[1], Sirima Wongwairot[1], Chawin Limsuwan[1], Viboonsak Yutil-tanachot[1], Surachai Leepitakrat[1], Somporn Yongpunsawasdi[1], Pornjarim Nilvanimit[1], Yossapong Paladsing[1], Erica Lindroth[1]



Molecular and Serologic Evidence of SFTSV Infection in Acute Febrile Illness Cases in Khon Kaen, Thailand

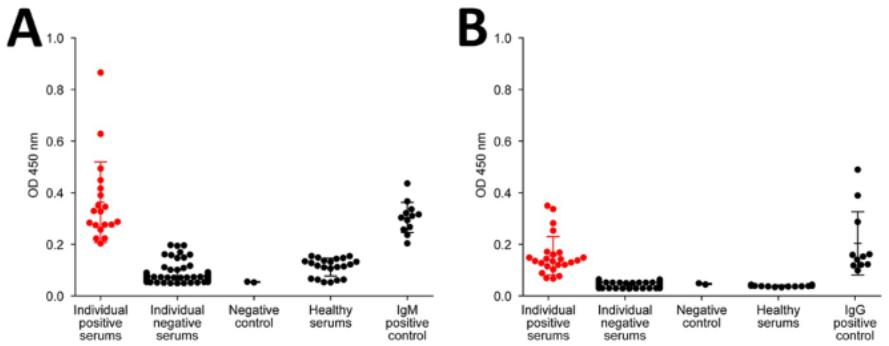
SFTSV RNA was detected in **1.6% (38/2,425)** of AFI patients at Chum Phae Hospital, Thailand (2015–2021).
Sex ratio (M:F): 1.4:1.0
Median age: 47.2 years (range: 15.9–86.7; IQR: 29–64)
No co-infections with other pathogens
Clinical features:

- Fever (mean 38.0°C, range 36.1–40.3°C)
- Headache (20.5%), dizziness (12.8%)
- Thrombocytopenia in 3 cases

All patients recovered without severe complications
SFTSV seropositivity: 16 patients (0.7%) IgM, 54 patients (2.2%) IgG, 3 patients (0.1%) both → **total 73 of 2,425 (3%)**

Average OD450 of SFTSV IgM positive control: 0.233

Average OD450 of SFTSV IgG positive control: 0.172



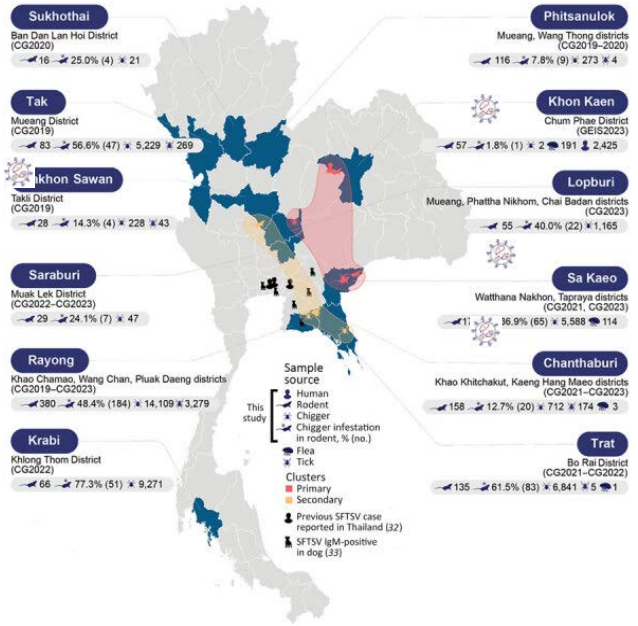
Appendix Figure 2. ELISA results showing optical density at 450 nm of the tested samples.

EMERGING INFECTIOUS DISEASES

Emerg Infect Dis. 2024 Nov;30(Suppl 2):S111–S119. doi: 10.3201/eid3014.240163

Comprehensive Surveillance of Severe Fever with Thrombocytopenia Syndrome Virus in Patients with Acute Febrile Illness, Wild Rodents, and Trombiculid Larval Mites, Thailand

Piyada Linsuwanon [1,✉], Yong Poovorawan [1], Keun Hwa Lee [1], Nutthanun Auysawasdi [1], Sirima Wongwairot [1], Chawin Limsuwan [1], Viboonsak Vuthitanachot [1], Surachai Leepitakrat [1], Sompong Vongpunsawasdi [1], Pornjarim Nilyanimit [1], Yossapong Paladsing [1], Erica Lindroth [1]



Assessing Rodents in SFTSV Transmission: qRT-PCR of 1,019 Rodents

Table 2. Positivity rates of SFTSV RNA detected in wild rodents, Thailand, 2015–2021*

Family	Species	No. (%) positive	SFTSV RNA–positive, by tissue			Average RNA level, copies/mL
			Lung	Liver	Spleen	
Muridae	*Rattus tanezumi* rat	1/559 (0.2)	–	1	–	4.07×10^4
	R. exulans rat	1/98 (1)	–	–	1	3.05×10^3
	R. novegicus rat	1/16 (6.3)	1	–	–	5.73×10^3
	Mus cervicolor mouse	0/6	–	–	–	–
	M. caroli mouse	1/7 (14.3)	1	–	–	4.03×10^3
	Bandicota indica rat	2/113 (1.8)	1	1	–	4.89×10^3
	B. savileii rat	2/121 (1.7)	–	2	–	1.01×10^4
	Maxomys surifer rat	0/23	–	–	–	–
	Niviventer fulvescens rat	0/5	–	–	–	–
	Berylmys berdmorei rat	1/23 (4.3)	–	–	1	1.71×10^4
	B. bowersi rat	0/1	–	–	–	–
	Chiromyscus chiropus rat	0/1	–	–	–	–
Tupaiidae	*Tupaia belangeri* shrew	0/19	–	–	–	–
	T. glis shrew	0/9	–	–	–	–
Sciuridae	*Menetes berdmorei* squirrel	2/19 (10.5)	1	–	1	4.06×10^3
3 families	15 species	11/11,019 (1.1)	4	4	3	

*SFTSV, severe fever with thrombocytopenia syndrome virus; –, negative result.

Eleven rodents from 8 species were positive for SFTSV RNA, indicating an overall positivity rate of 1.1%.

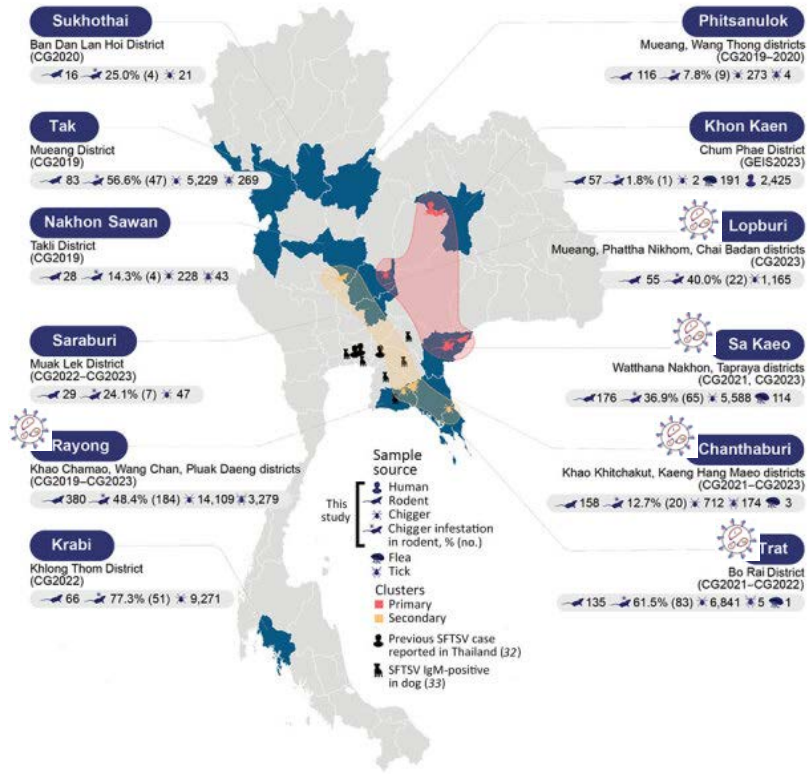
SFTSV RNA Detected in Chiggers from Wild Rodents

EMERGING INFECTIOUS DISEASES

Emerg Infect Dis. 2024 Nov;30(Suppl 2):S111–S119. doi: 10.3201/eid3014.240163

Comprehensive Surveillance of Severe Fever with Thrombocytopenia Syndrome Virus in Patients with Acute Febrile Illness, Wild Rodents, and Trombiculid Larval Mites, Thailand

Piyada Linsuwanon [1,✉], Yong Poovorawan [1], Keun Hwa Lee [1], Nutthanun Auysawasdi [1], Sirima Wongwairot [1], Chawin Limsuwan [1], Viboonsak Vuthitanachot [1], Surachai Leepitakrat [1], Sompong Vongpunsawasdi [1], Pornjarim Nilyanimit [1], Yossapong Paladsing [1], Erica Lindroth [1]



Appendix Table 2. SFTSV RNA positivity rates in chiggers

Family	Genus	N chigger	N positive (%)	N positive by host species: *Rattus tanezumi*	*Rattus exulans*	*Rattus norvegicus*	*Mus cervicolor*	*Mus caroli*	*Bandicota indica*	*Bandicota savilei*	*Maxomys surifer*	*Niviventer fulvescens*	*Berylmys berdmorei*	*Berylmys bowersi*	*Chiromyscus chiropus*	*Tupaia belangeri*	*Tupaia alis*	*Menetes berdmorei*	Average RNA level (copies/ml)
Trombiculidae	*Ascoschoengastia* sp.	178	1 (0.6%)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.85×10^4
	Leptotrombidium sp.	73	1 (1.4%)	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1.49×10^4
	Walchia sp.	163	5 (3.1%)	1	-	-	-	-	1	3	-	-	-	-	-	-	-	-	2.89×10^4
	Blankaartia sp.	1	1 (100%)	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1.38×10^4
	Gahrliepia sp.	136	-																
	Walchiella sp.	6	-																
	Schoengastiella sp.	3	-																
	Eutrombicula sp.	2	-																
	Helenicula sp.	1	-																
Unidentified	Other mites	10	-																
	10 genera	573	8 (1.4%)	2	-	-	-	-	2	3	-	-	-	-	-	1	-	-	2.39×10^4

8 of 573 chiggers (1.4%) from 155 wild rodents were SFTSV RNA–positive (avg. 2.4×10^4 copies/chigger); positive chiggers were collected from 6 rodents and belonged to 4 chigger genera.

EMERGING INFECTIOUS DISEASES

• Emerg Infect Dis. 2024 Nov;30(Suppl 2):S111–S119. doi: 10.3201/eid3014.240163

Comprehensive Surveillance of Severe Fever with Thrombocytopenia Syndrome Virus in Patients with Acute Febrile Illness, Wild Rodents, and Trombiculid Larval Mites, Thailand

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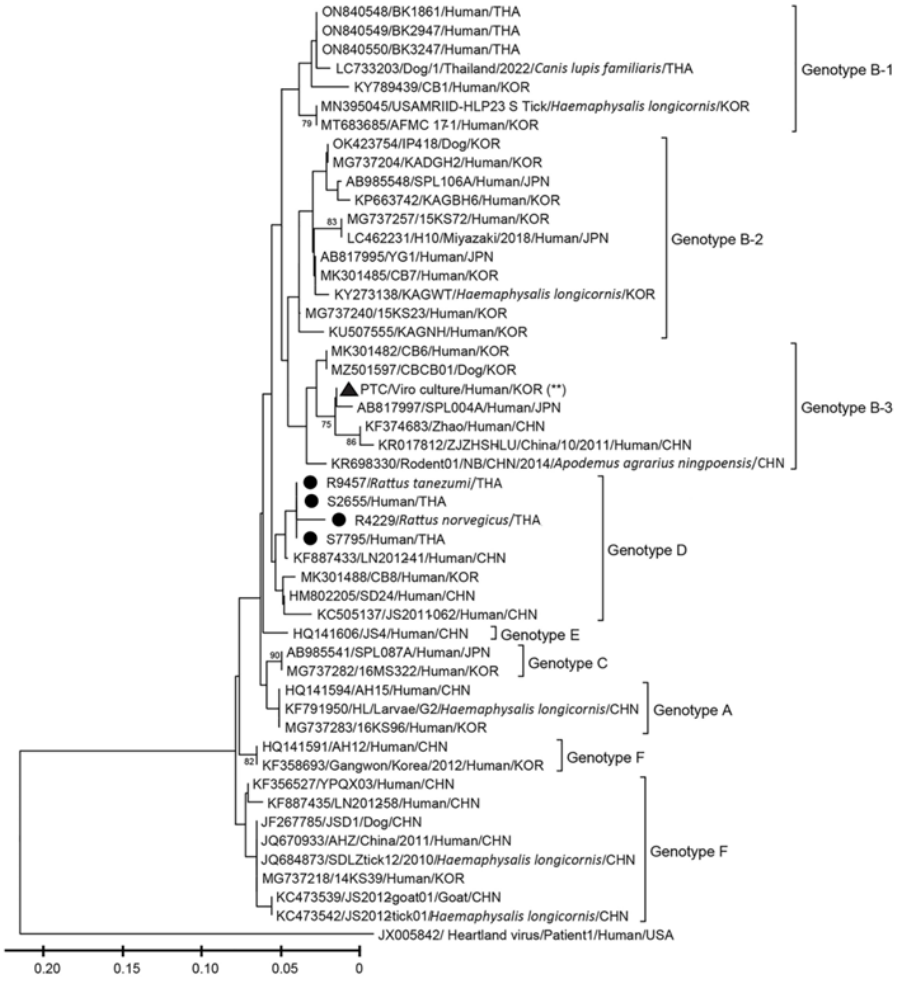


Phylogenetic analysis of the partial NS gene sequence (124 bp) from two SFTSV RNA–positive patients and two rodents revealed a close genetic relationship to genotype D.

The strains shared high nucleotide similarity with strain LN2012–41 (GenBank accession no. KF887433), which was previously identified in a patient in China in 2012.

viruses

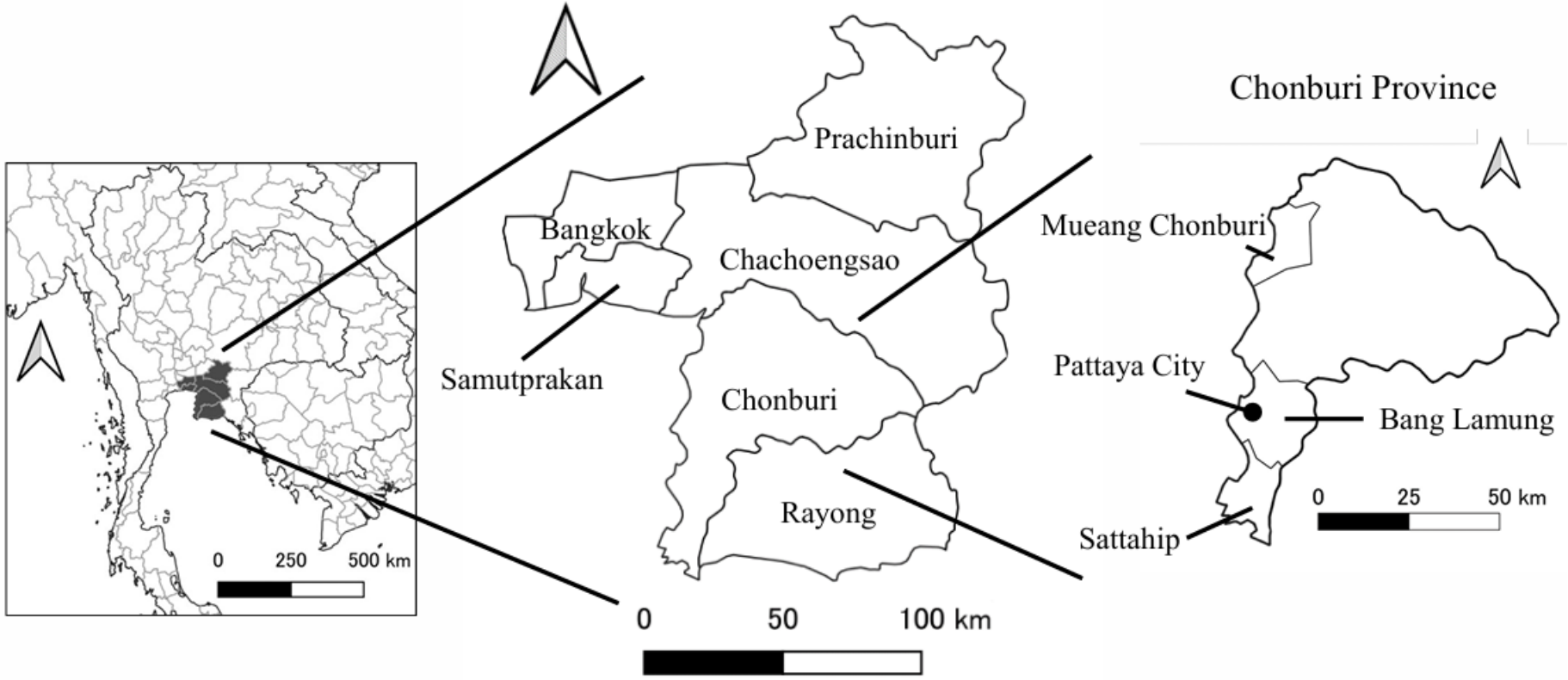
MDPI

Brief Report

High Seroprevalence of Severe Fever with Thrombocytopenia Syndrome Virus Infection among the Dog Population in Thailand

Keita Ishijima [1,†], Thanmaporn Phichitraslip [2,†], Nattakarn Naimon [2], Preeyaporn Ploypichai [2], Benyapa Kriebkajon [2], Torntun Chinarak [2], Jirasin Sridaphan [2], Anamika Kritiyakan [2], Noppadol Prasertsincharoen [2], Sathaporn Jittapalapong [2], Kanate Tangcham [3], Worawut Rerkamnuaychoke [4], Yudai Kuroda [1], Masakatsu Taira [1], Kango Tatemoto [1], Eunsil Park [1], Milagros Virhuez-Mendoza [1], Yusuke Inoue [1,5], Michiko Harada [1,5], Tsukasa Yamamoto [1,5], Ayano Nishino [1,5], Aya Matsuu [1] and Ken Maeda [1,5,*]

Dog serum samples (n=458) were collected from 16 districts across six provinces in Thailand between April 2021 and April 2022.



viruses

MDPI

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Detection of Anti-SFTSV Antibodies from Dogs

Results of the anti-SFTSV IgG ELISA and virus-neutralization test in dogs in Thailand.

Province	District	ELISA (OD > 0.129)		50% Focus Reduction Neutralization Test (≥1:10)		Minimum Positive Ratio (%)
		No. of Examined Dogs	No. of Positive Dogs	No. of Examined Dogs	No. of Positive Dogs	
Prachinburi		17	1	1	0	0.0
Bangkok		143	12	12	6	4.2
Chachoengsao		18	2	2	2	11.1
Samutprakan		81	19	16	10	12.3
Rayong		14	2	2	1	7.1
Chonburi	Mueang Chonburi	27	6	6	3	11.1
	Bang Lamung	56	5	5	3	5.4
	Sattahip	95	56	52	50	52.6
	Pattaya city	7	3	2	1	14.3
Total		458	106	98	76	16.6

- First screening showed 106 dogs (23.1%) were seropositive for anti-SFTSV IgG.
- 76 of 98 (**16.6%**) samples were confirmed positive by FRNT50
- Highest regional seropositive rate:
  → Sattahip, Chonburi with 52.6%
- Further analysis revealed:
  → Most positive samples came from a dog shelter in Sattahip
  → In February 2022, 50 of 64 dogs at this shelter were positive (78% seropositivity)

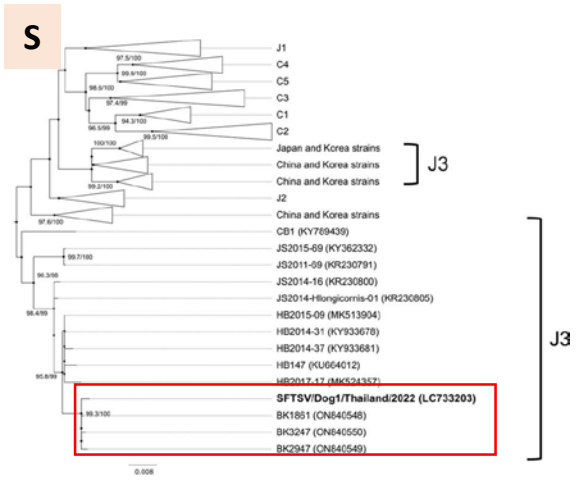
viruses
MDPI
Brief Report

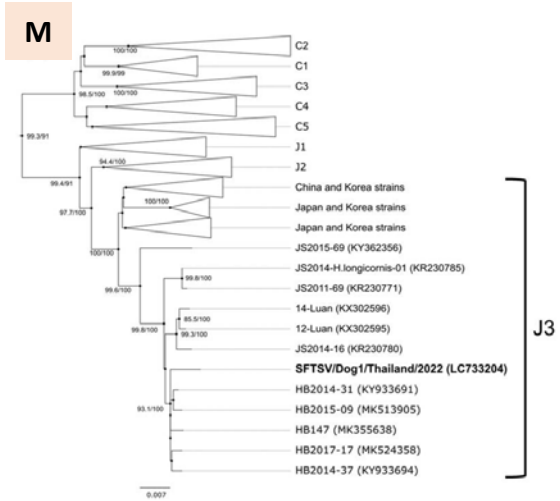
High Seroprevalence of Severe Fever with Thrombocytopenia Syndrome Virus Infection among the Dog Population in Thailand

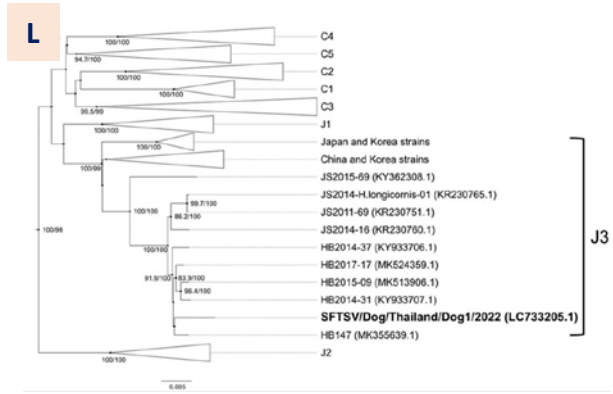
Keita Ishijima [1,2], Thanmapoen Phichitraslip [2,3], Nattakarn Naimon [2], Preeyapoen Ploypichai [2], Benyapa Kriebkajon [2], Torntun Chinarak [2], Jirasin Sridaphan [2], Anamika Kritiyakan [2], Noppadol Prasertwincharoen [2], Sathaporn Jittapalapong [2], Kanate Tangchan [1], Worawat Rerkamnuaychoke [4], Yudai Kuroda [1], Masakatsu Taira [1], Kango Tatemoto [1], Eunsil Park [1], Milagros Virhuez-Mendoza [1], Yusuke Inoue [1,5], Michiko Harada [1,5], Tsukasa Yamamoto [1,5], Ayano Nishino [1,5], Aya Matsuu [1] and Ken Maeda [1,6,*]

SFTSV RNA Detection and Genome Sequencing

- **RT-PCR** performed on **57 dog serum samples** (Sattahip, Feb 2022)
  → **7 samples** excluded due to insufficient volume
- **SFTSV RNA detected** in **1 sample** from a healthy dog
- Complete coding sequences of **S**, **M**, and **L segments** were obtained
- Virus designated:
  → **SFTSV/Dog/Thailand/Dog1/2022**
- Nucleotide sequences closely related to:
  → **SFTSV strains from Thailand and China**







SFTSV Seroprevalence in Humans and PCR-Based Tick Surveillance in Thailand, 2019-2023

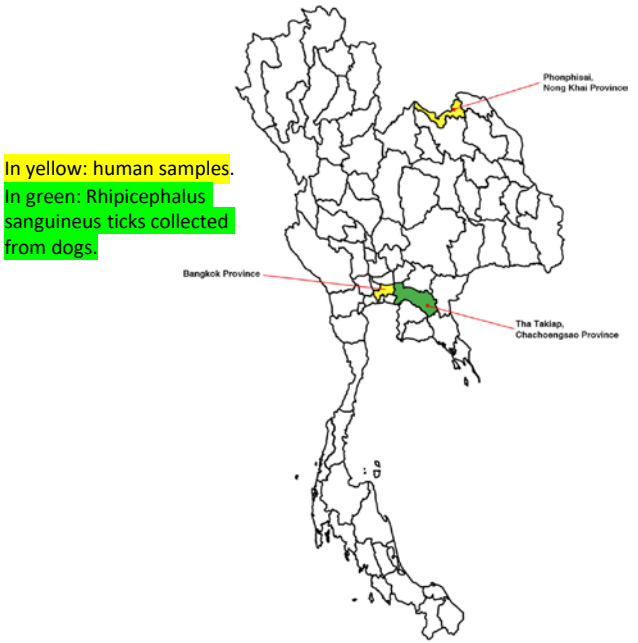


Table 1 Human seroprevalence of severe fever with thrombocytopenia syndrome and molecular analysis of *Rhipicephalus sanguineus* ticks in Thailand.

From: Seroprevalence study in humans and molecular detection in *Rhipicephalus sanguineus* ticks of severe fever with thrombocytopenia syndrome virus in Thailand

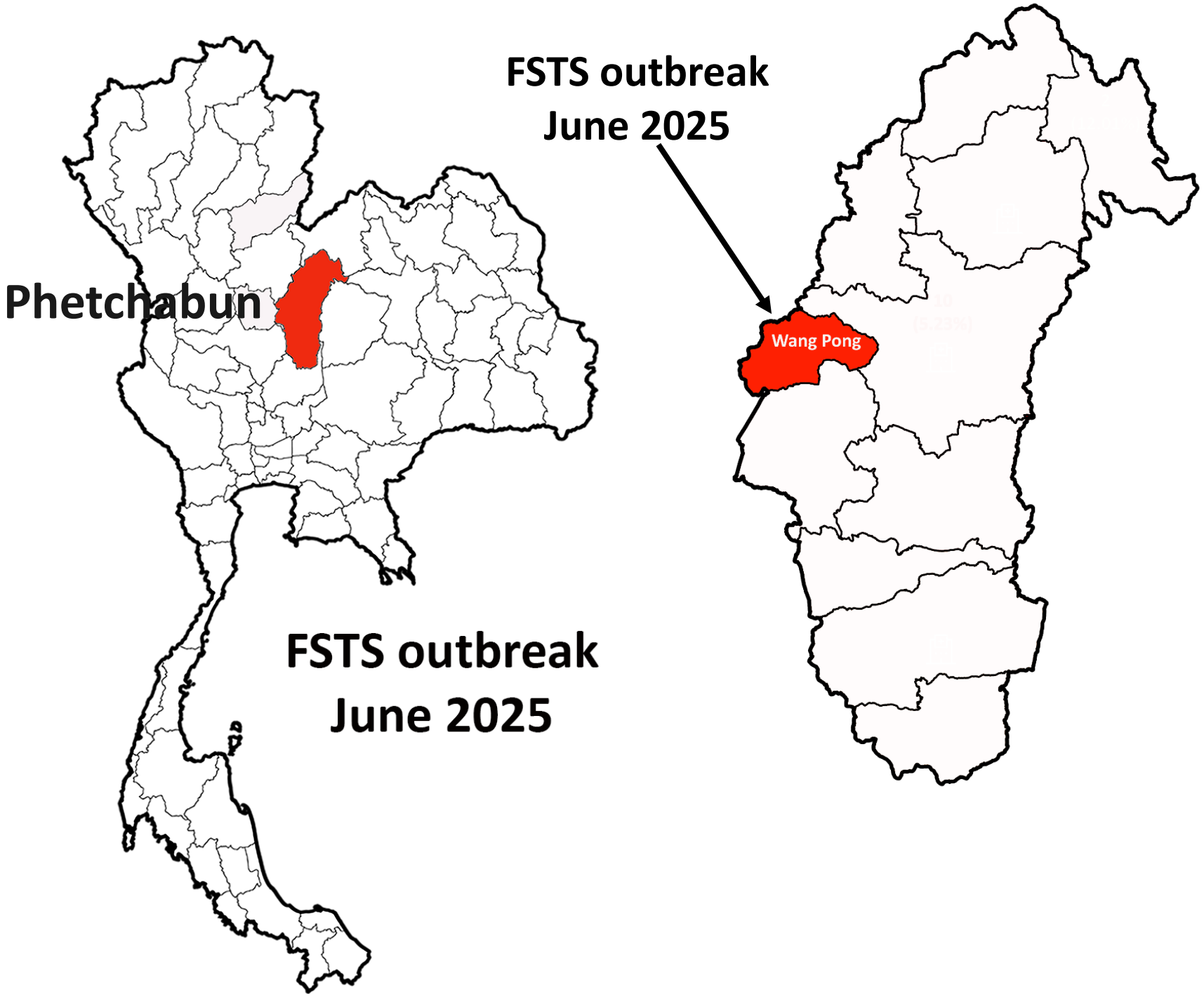
Sample	Collection	Location	Province	SFTSV					
				ELISA		VNT		qPCR[a]	
				No. total	No. pos	No. total	No. pos	No. total	No. pos
Human sera	Blood donors	Thai Red Cross	Bangkok	940	5	5	0	NA	NA
Human sera	Dengue suspected	Phonphisai Hospital	Nong Khai	222	7	7	0	NA	NA
Rh. sanguineus ticks	Dogs	Tha Takiap Subdistrict	Chachoengsao	NA	NA	NA	NA	433 (50 pools)	0
Rh. sanguineus eggs	*Rh. sanguineus* ticks	Tha Takiap Subdistrict	Chachoengsao	NA	NA	NA	NA	12 pools	0

ELISA Enzyme-linked immunosorbent assay, *NA* Not applicable, *pos* Positive, *qPCR* Real-time polymerase chain reaction, *SFTSV* Severe fever with thrombocytopenia syndrome virus, *VNT* Virus neutralization test.
[a]Pathogens: SFTSV, Crimean-Congo hemorrhagic fever, *Coxiella* spp., *Bartonella* spp., and *Rickettsia* spp.

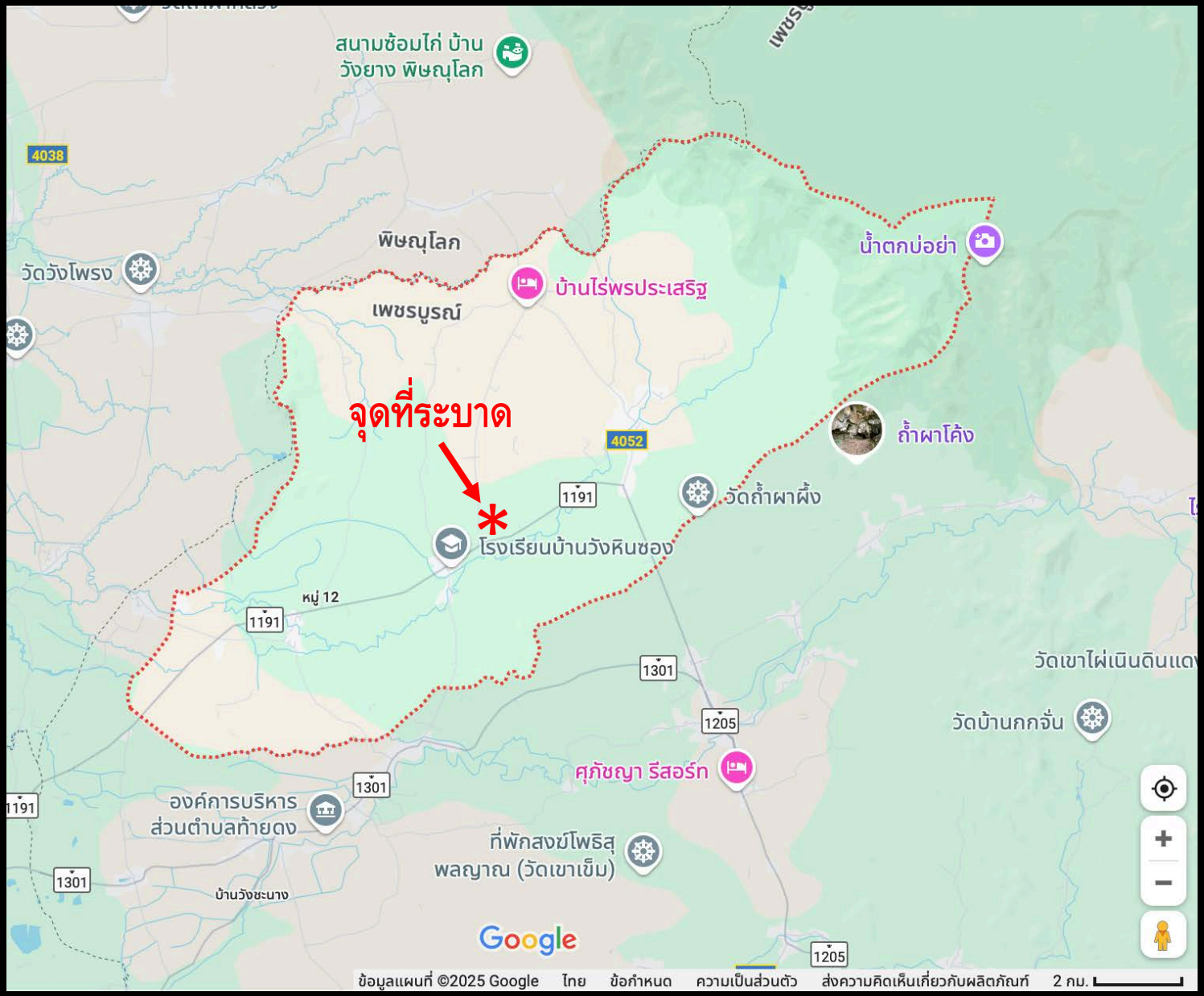
- 1,162 human serum samples from Bangkok (940 asymptomatic adult volunteer blood donors) and Nong Khai (individuals suspected of dengue virus) were tested for anti-SFTSV IgG
  → 12 samples (1.1%) were ELISA-positive
  → All 12 negative in virus neutralization test

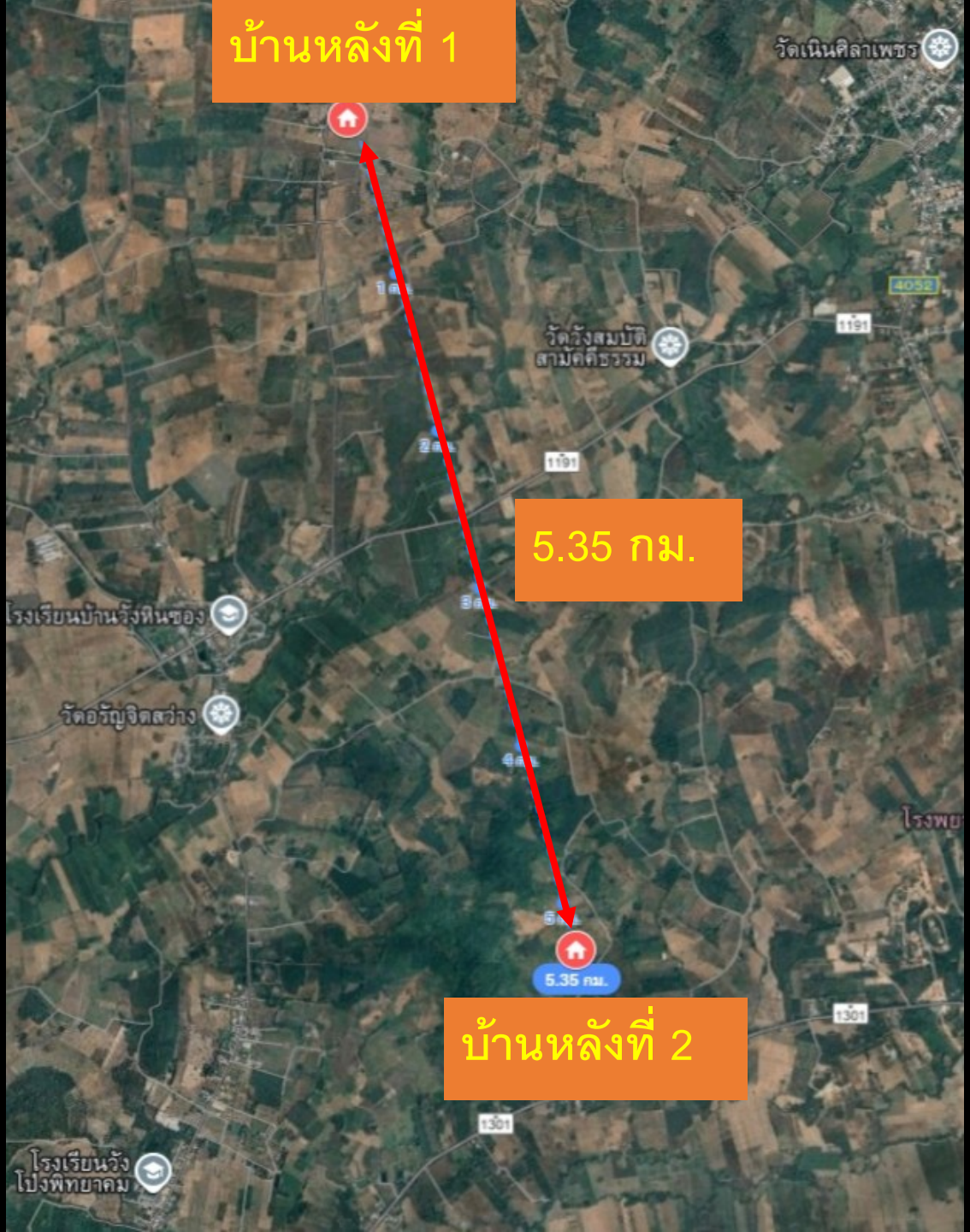
- 433 Rh. sanguineus ticks from 49 dogs (Chachoengsao, 2023) tested for: SFTSV, CCHF, Coxiella spp., Bartonella spp., and Rickettsia spp.
  → No pathogens detected

Outbreak of SFTS with 2 Fatal Cases


FSTS outbreak
June 2025
Phetchabun
Wang Pong
FSTS outbreak
June 2025

จุดที่เกิดการระบาด




บ้านหลังที่ 1
5.35 กม.
บ้านหลังที่ 2
วัดเนินศิลาเพชร
วัดวังสมบัติ
สามัคคีธรรม
โรงเรียนบ้านวังหินซอง
วัดอรัญจิตสว่าง
โรงเรียนวัง
โป่งพิทยาคม
4052
1191
1301
5.35 กม.

Case 1. (Fatal case)

- ชายไทยอายุ 82 ปี อาศัยอยู่วังโป่ง จังหวัดเพชรบูรณ์ แข็งแรงดี
- 3 วัน ไข้ ไอเสมหะเหนียวๆ ไม่มีน้ำมูก ไม่เหนื่อย ไม่ปวดท้อง ยังรู้ตัวรู้เรื่อง ไม่มีแขนขาอ่อนแรง ไปตรวจคลินิกฉีดยา อาการไม่ดีขึ้น
- 1 วัน สังเกตว่าพูดงงๆ ช้าลงกว่าเดิม บางครั้งไม่ค่อยรู้เรื่อง แต่ขยับแขนขาพอๆ กัน 2 ข้าง พอลุกเดินเข้าห้องน้ำได้ ไม่เหนื่อย ไข้อยู่ ปวดท้องบริเวณท้องน้อย ไม่มีท้องเสียถ่ายเหลว ไม่มีคลื่นไส้อาเจียน

ตรวจร่างกาย

- **Good consciousness with, agitation, not pale, no jaundice**
- **Heart lungs:** ปกติ
- **Abdomen:** soft, mild tender at mid lower abdomen
- **Ext.:** no edema
- **Neuro:** mild agitation, follow to one step command, disorientation to place

CBC แรกรับ

HB 13.9 gm%

WBC 3210/mm^3

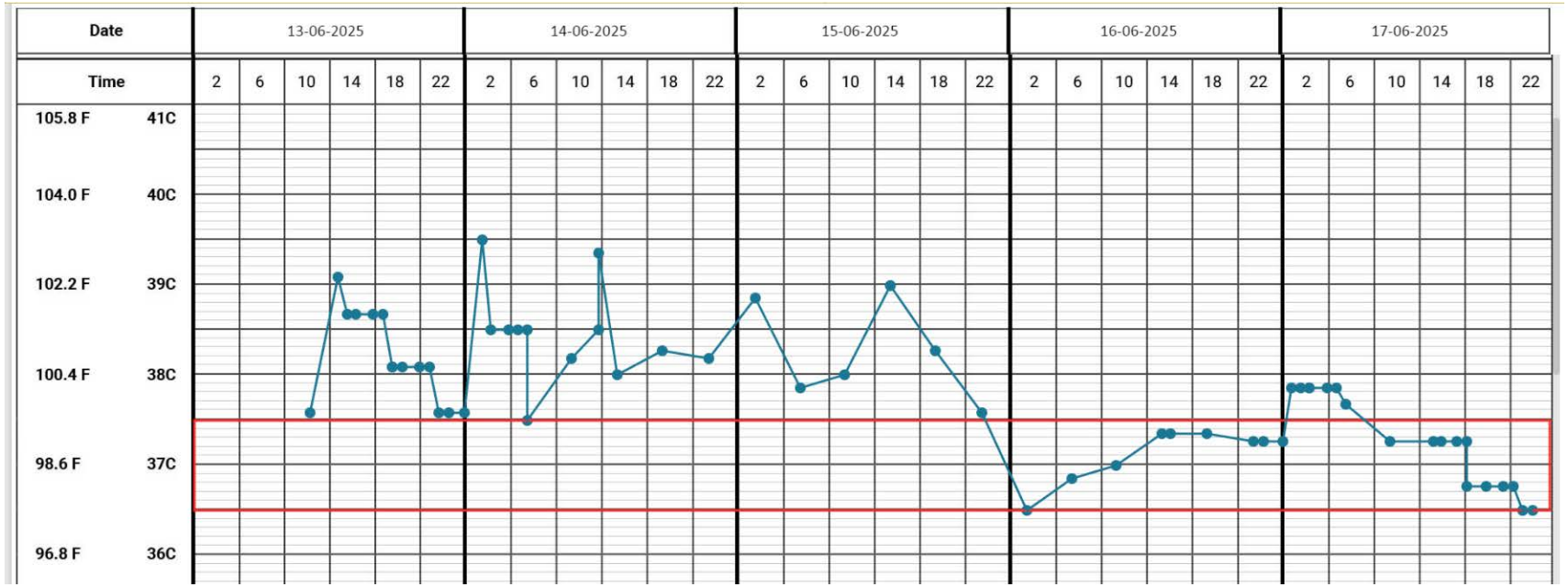
Platelets 117,000/mm^3

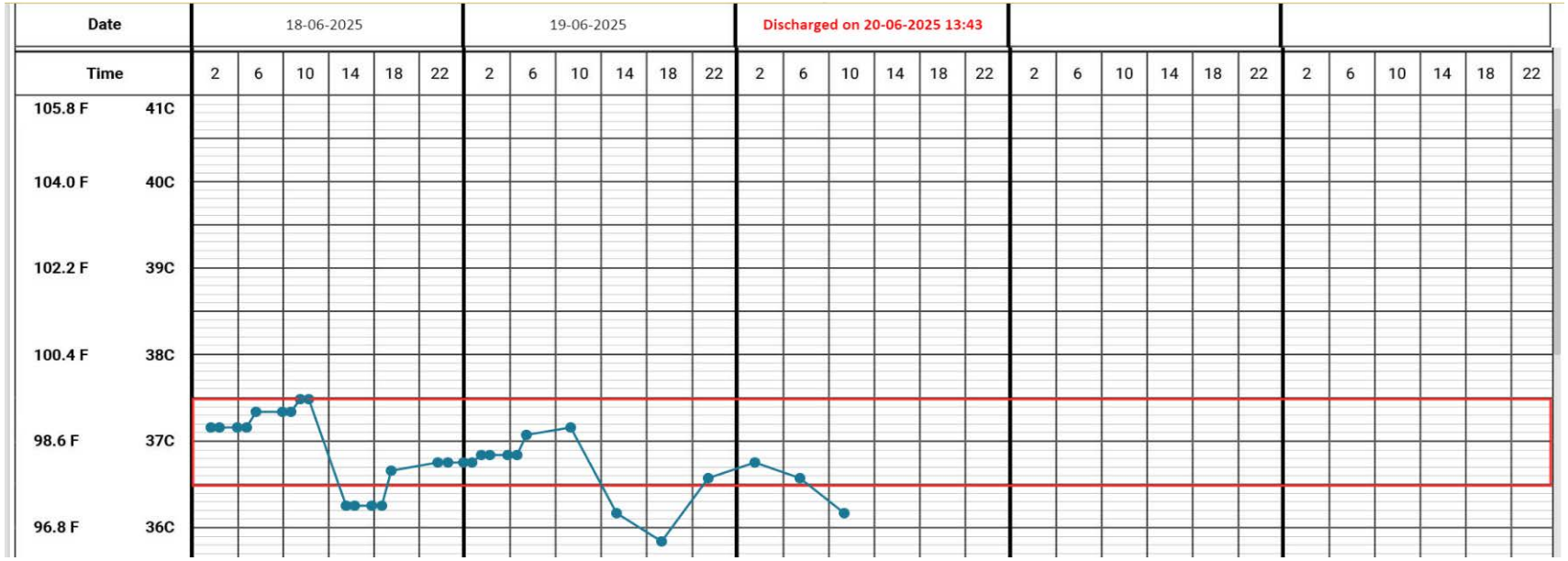
Platelets count แรกรับ

117000 → 38000 cumm

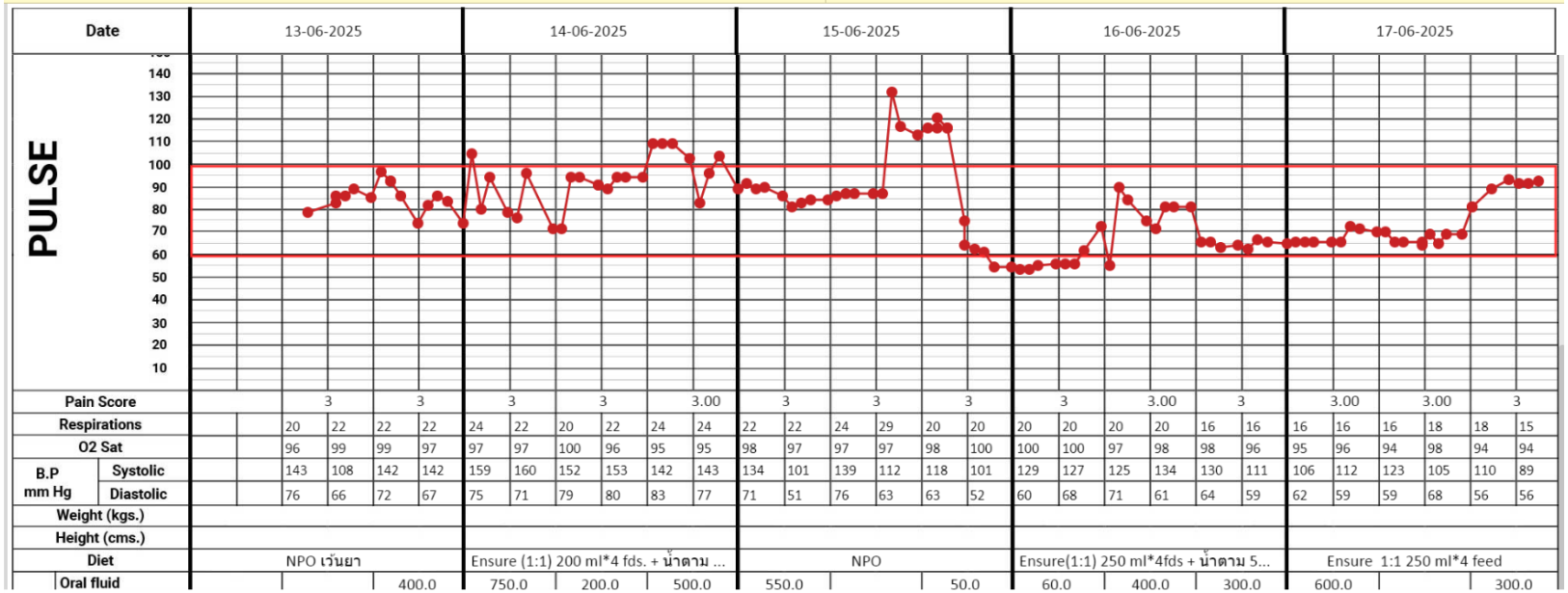
(13-6-68) → (18-6-68)

Temperature



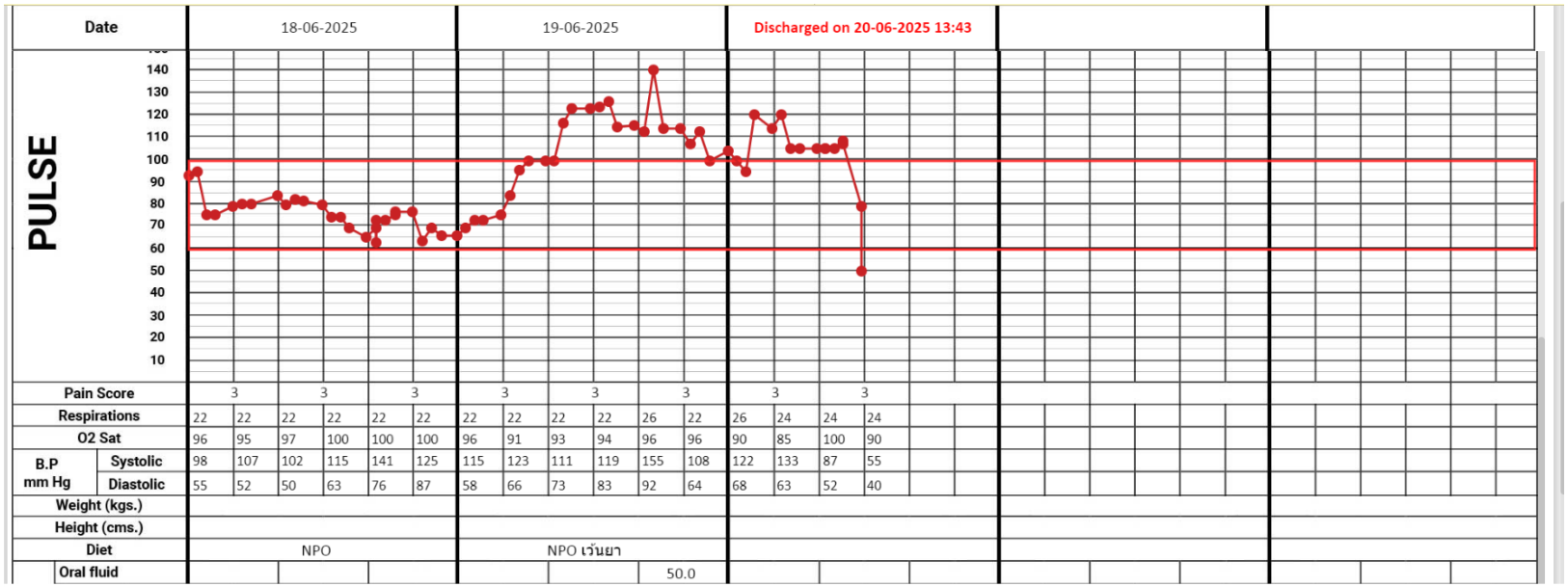


Pulse rate



Date		13-06-2025				14-06-2025					
Pain Score				3		3		3			3.00
Respirations				20	22	22	22	24	22	20	22
O2 Sat				96	99	99	97	97	97	100	96
B.P mm Hg	Systolic			143	108	142	142	159	160	152	153
	Diastolic			76	66	72	67	75	71	79	80
Weight (kgs.)											
Height (cms.)											
Diet				NPO เว้นยา				Ensure (1:1) 200 ml*4 fds. + น้ำตาม ...			
Oral fluid						400.0		750.0		200.0	

Date		14-06-2025			15-06-2025						16-06-2025						17-06-2025					
Pain Score		3			3			3				3.00			3			3.00			3.00		
Respirations		24	24	24	22	22	24	29	20	20	20	20	20	16	16	16	16	16	18	18	15	
O2 Sat		95	95	97	98	97	97	97	98	100	100	100	97	98	98	96	95	96	94	98	94	94
B.P mm Hg	Systolic	142	143	134	101	139	112	118	101	129	127	125	134	130	111	106	112	123	105	110	89	
	Diastolic	83	77	71	51	76	63	63	52	60	68	71	61	64	59	62	59	59	68	56	56	
Weight (kgs.)																						
Height (cms.)																						
Diet		Ensure (1:1) 200 ml*4 fds. + น้ำตาม ...			NPO						Ensure(1:1) 250 ml*4fds + น้ำตาม 5...						Ensure 1:1 250 ml*4 feed					
Oral fluid		500.0			550.0			50.0			60.0	400.0		300.0			600.0			300.0		



Date		18-06-2025						19-06-2025						Discharged on 20-06-2025 13:43			
Pain Score		3		3		3		3		3			3	3			
Respirations		22	22	22	22	22	22	22	22	22	22	26	22	26	24	24	24
O2 Sat		96	95	97	100	100	100	96	91	93	94	96	96	90	85	100	90
B.P mm Hg	Systolic	98	107	102	115	141	125	115	123	111	119	155	108	122	133	87	55
	Diastolic	55	52	50	63	76	87	58	66	73	83	92	64	68	63	52	40
Weight (kgs.)																	
Height (cms.)																	
Diet		NPO						NPO เว้นยา									
Oral fluid												50.0					

Case 2 Severe Fever with Thrombocytopenic Syndrome

- ชายไทย 56 ปี Hypertension and BPH อาศัยอยู่วังโป่ง จังหวัดเพชรบูรณ์ He lived in the rural area in the farmland and exposure to stray and pet dogs.
- He was referred from Wang Pong Hospital. He had fever, dyspnea, cough, and malaise for 1 day and referred from district hospital. 1 day after admission, the patient had high fever and worsening respiratory distress despite mechanical ventilation.
- He had a dark lesion on the left foot.
- He had closed contact with the first case with confirmed SFTS case on 9/6/2568.

ตรวจร่างกาย

- Vital Signs: BT: 38.1 °C PR: 148/min RR: 32/min BP: 74/55 mmHg SpO_2: 100%
- BT 38.1 °C PR 148 /min. RR 32 /min. BP = 74/55 SpO2 100 %

- drowsiness on sedation, mild agitation, not follow to command.

CBC แรกรับ

HB 16.4 gm%

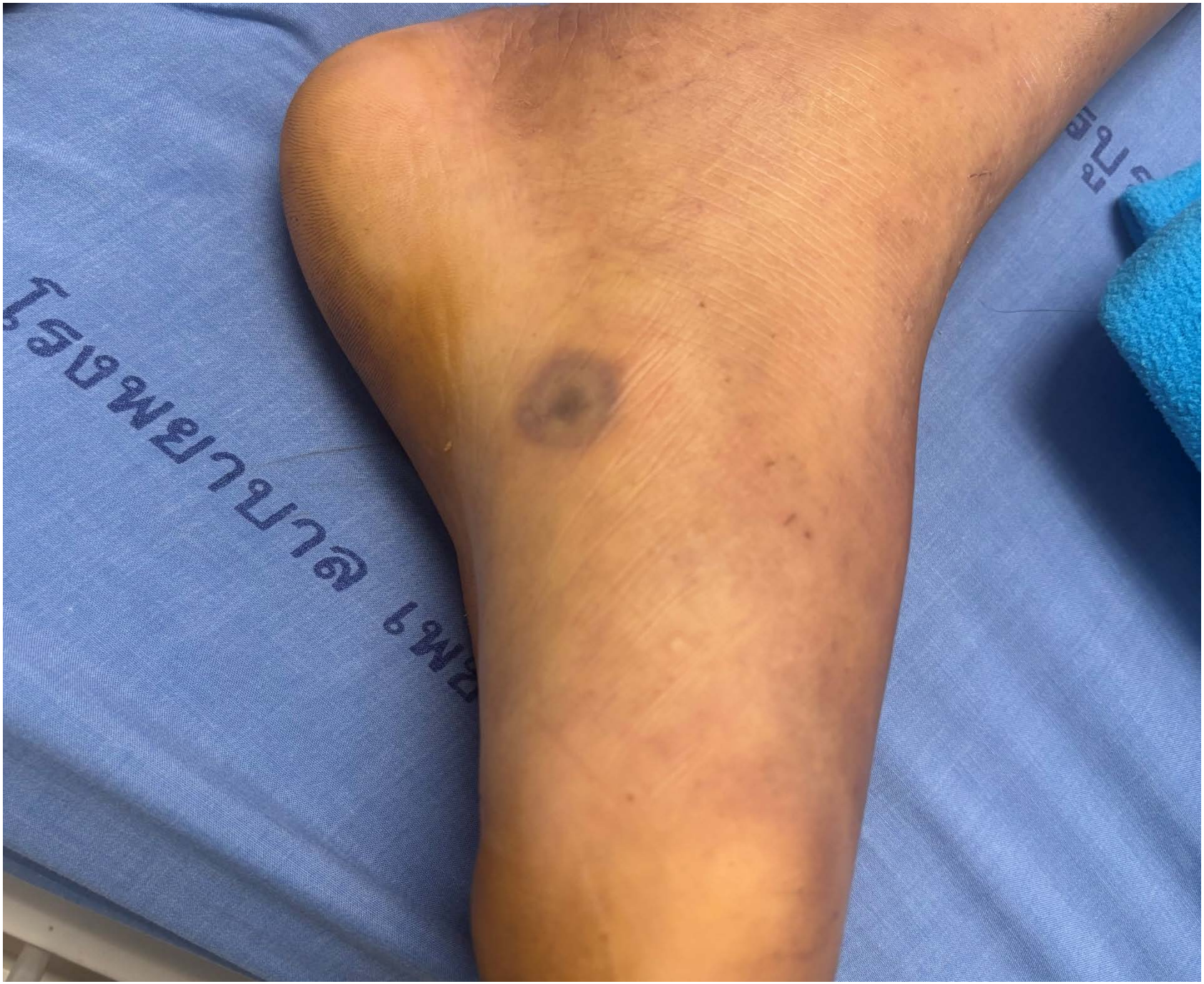
WBC 8210/mm^3

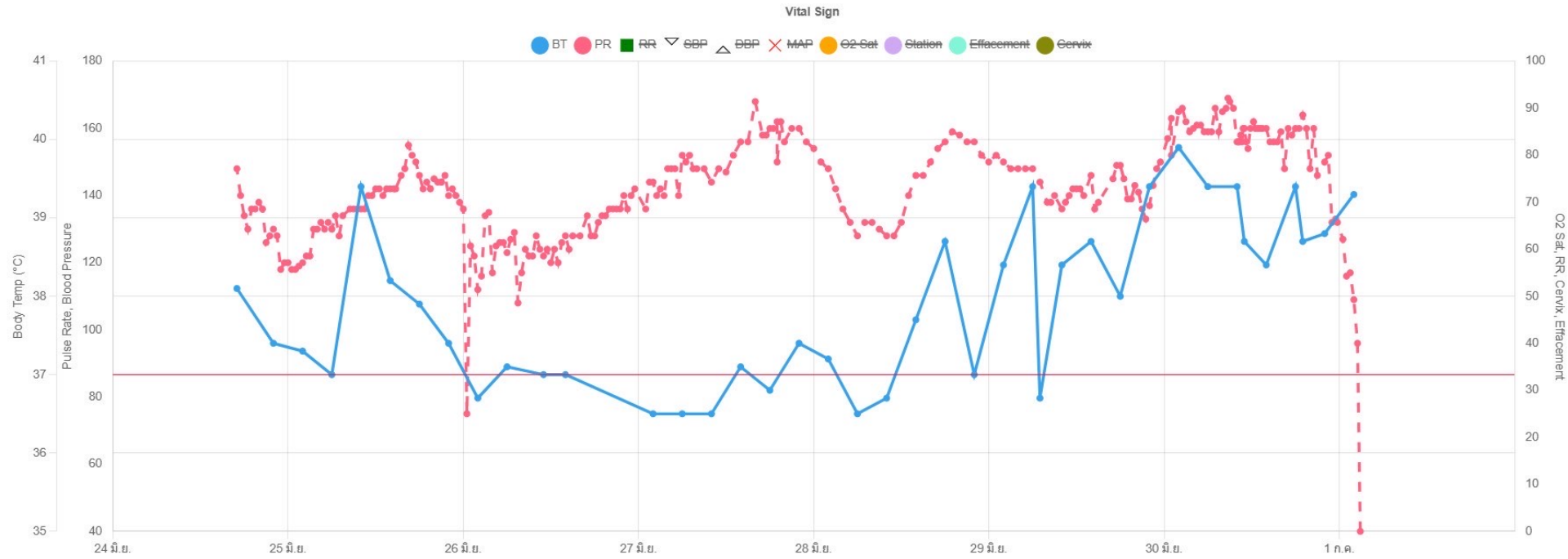
Platelets 203,000/mm^3

Platelets count แรกรับ

203,000 → 93,000 cumm

(13-6-68) → (18-6-68) cumm




Vital Sign
BT
PR
RR
SBP
DBP
MAP
O2 Sat
Station
Effacement
Cervix
Body Temp (°C)
Pulse Rate, Blood Pressure
O2 Sat, RR, Cervix, Effacement
41
40
39
38
37
36
35
180
160
140
120
100
80
60
40
100
90
80
70
60
50
40
30
20
10
0
24 มิ.ย.
25 มิ.ย.
26 มิ.ย.
27 มิ.ย.
28 มิ.ย.
29 มิ.ย.
30 มิ.ย.
1 ก.ค.

Characteristics of specimens positive for SFTSV, Thailand

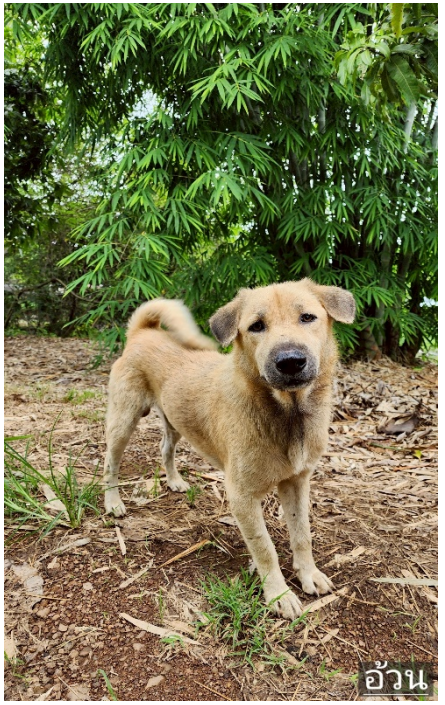
Source	Age	Sex	Day of illness	Specimen types	qRT-PCR (Ct value)
Human, Case 1	82	Male	5	CSF	34.18
			7	Plasma	26.29
Human, Case 2	56	Male	3	Plasma	29.45
			7	Urine	32.25
			7	Stool	28.59
			7	Nasopharyngeal swab	30.00
			7	Throat swab	28.98

บ้านหลังที่ 1

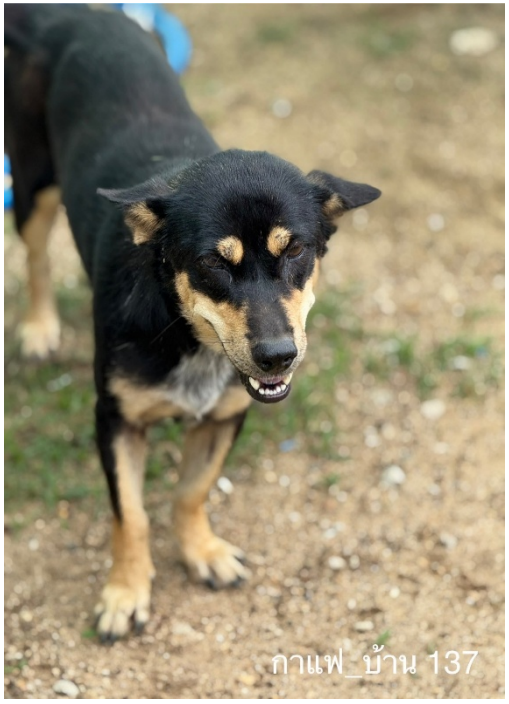
บ้านหลังที่ 2


มะขาม


ฟูฟู


อ้วน


ปีโป้


กาแฟ_บ้าน 137


อินเดีย


สี่ตา


สตางค์

From house of patient case-2

เห็บสุนัข

Rhipicephalus sanguineus

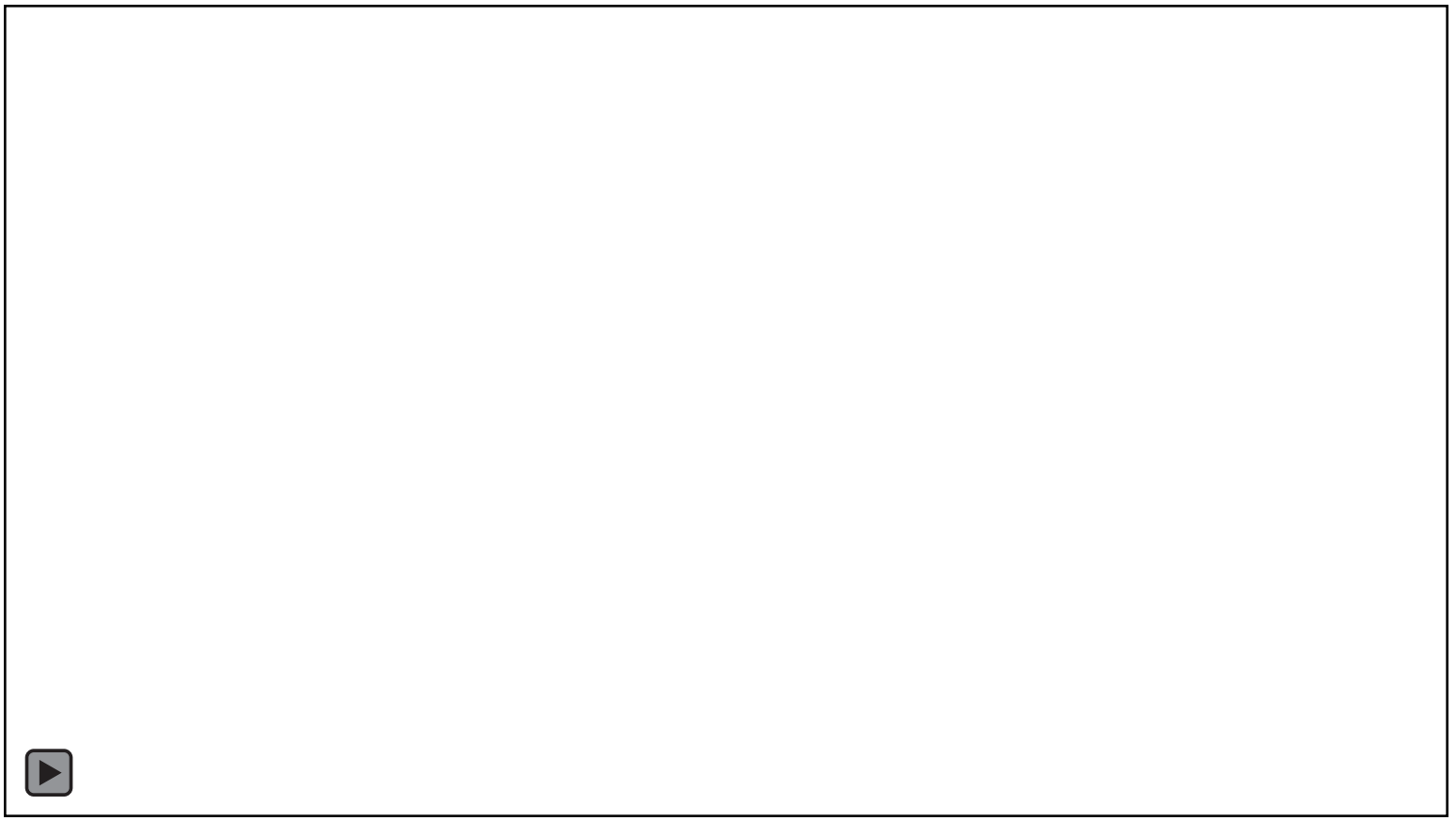
Nymph

Rhipicephalus sanguineus

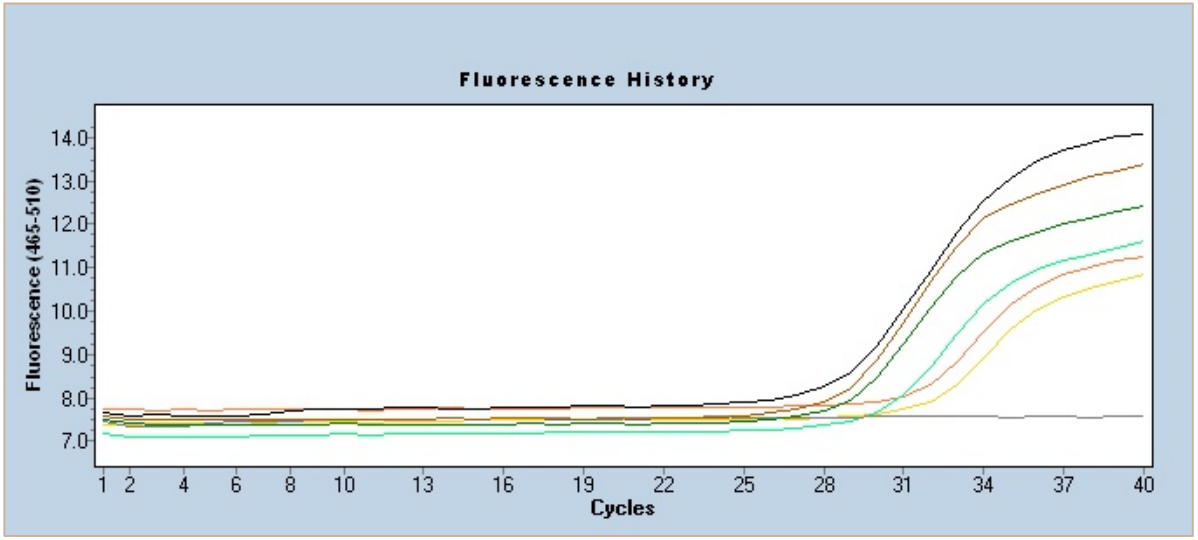
Adult male

Rhipicephalus sanguineus

Adult female



Real-time RT-PCR Results for SFTSV Detection



- Negative control
- Positive control for SFTSV (Ct = 27.56)
- Sample ID: PHU12, urine collected at 30/06/2025 (Ct=32.25)
- Sample ID: PHU12.2, sediment (centrifuged) (Ct=31.91)
- Sample ID: PHN12, NP collected at 30/06/2025 (Ct=30.00)
- Sample ID: PHT12, throat swab collected at 30/06/2025 (Ct=28.98)
- Sample ID: PHF12, stool collected at 30/06/2025 (Ct=28.59)

Case No.2
นาย สมชาย ขุนพล

1) SFTSV RNA was detected in all sample types collected from the patient, including urine, nasopharyngeal swab, throat swab, and stool. 2) The lowest Ct values, indicating the highest viral load, were observed in the stool and throat swab specimens. 3) Centrifugation of urine slightly improved detection sensitivity compared to unprocessed urine. 4) These findings suggest that collecting multiple specimen types can enhance diagnostic accuracy in SFTSV infection.

Patient case 2

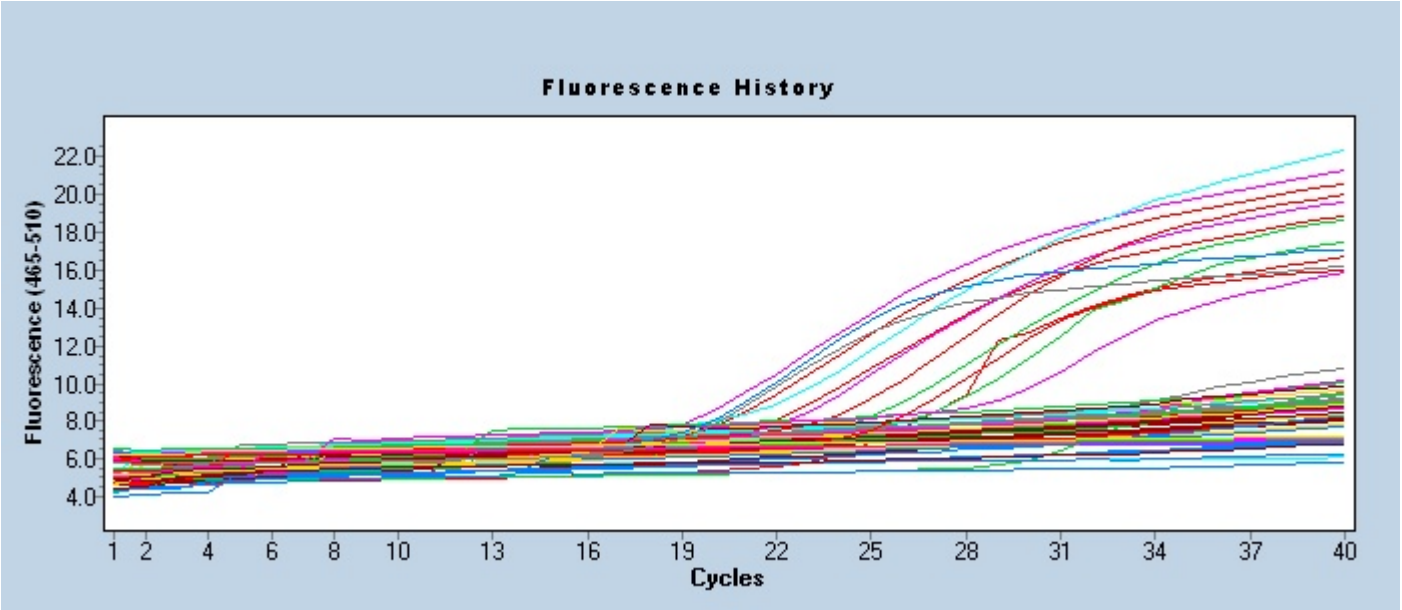
Partial S segment of the SFTSV

Case No. 2

Partial S segment (477 bp) of SFTSV was successfully amplified from urine, nasopharyngeal swab, throat swab, and stool samples of the patient. This demonstrates that SFTSV RNA can be detected in multiple specimen types, supporting molecular confirmation across different clinical materials.

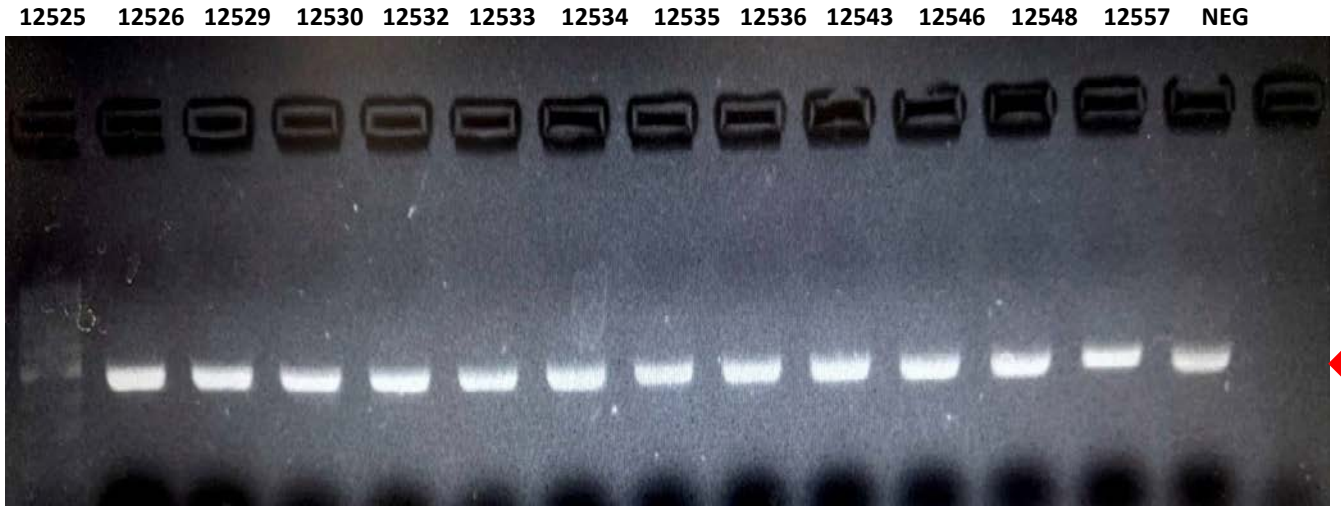
Patient case 2

Real-time RT-PCR Results for SFTSV Detection



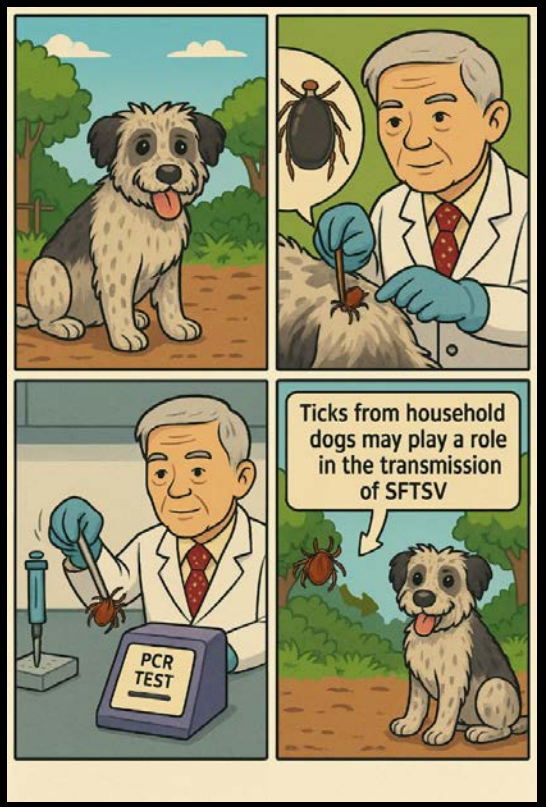
Partial S segment of the SFTSV

Rhipicephalus sanguineus



Summary of SFTSV Detection in Ticks from Pet Dogs of the Second Fatal Case

- A total of 44 ticks were collected from 5 pet dogs belonging to the second patient who died from SFTSV infection in Thailand.
- 13 ticks tested positive for SFTSV RNA by qRT-PCR.
- These positive ticks were found on 4 dogs:
  - Satang สตางค์ (black and white) – 9 ticks
  - Makham มะขาม (white) – 2 ticks
  - Taew แต้ว (brown) – 1 tick
  - Ting ทิ้ง (brown) – 1 tick
- Life stages and sex of the SFTSV-positive ticks:
  - Adult females: 7 ticks
  - Adult males: 6 ticks
- The positivity rate was 29.5% (13 out of 44 ticks).



From house of patient case-2

Laboratory testing to determine the presence of neutralizing antibodies against SFTSV (HB29 strain) using the SFTSV RVP microneutralization assay

Host	No. of positive	Positive rate per species
Human (n=48)	8	16.67%
Dog/Canine (n=30)	11	36.67%
Cat/Feline (n=7)	0	0%
Cow/Bovine (n=2)	0	0%
Rodent (n=1)	1	100.00%

We tested 88 sera from close contacts and animals, all PCR-negative. Using the SFTSV microneutralization assay, 23% were positive overall, mainly dogs and one rodent, with some humans. This suggests the virus is already circulating locally, with dogs and rodents likely being part of its natural cycle.

SFTSV Detection in Animals and Ticks Phitsanulok and Phetchabun Provinces, Thailand

Animal Samples (Dogs & Cats) – Phitsanulok

Total tested: 139 samples (90 dogs, 49 cats)

PCR results:

3 dog samples positive for SFTSV RNA

- Bang Rakam District (Ct = 33.15, 35.39)
- Chat Trakan District (Ct = 37.23)

Serology:

13 sera tested for neutralizing antibodies (6 dogs, 7 cats)

2 dog sera positive for neutralizing antibodies against SFTSV

Tick Samples – Phitsanulok & Phetchabun

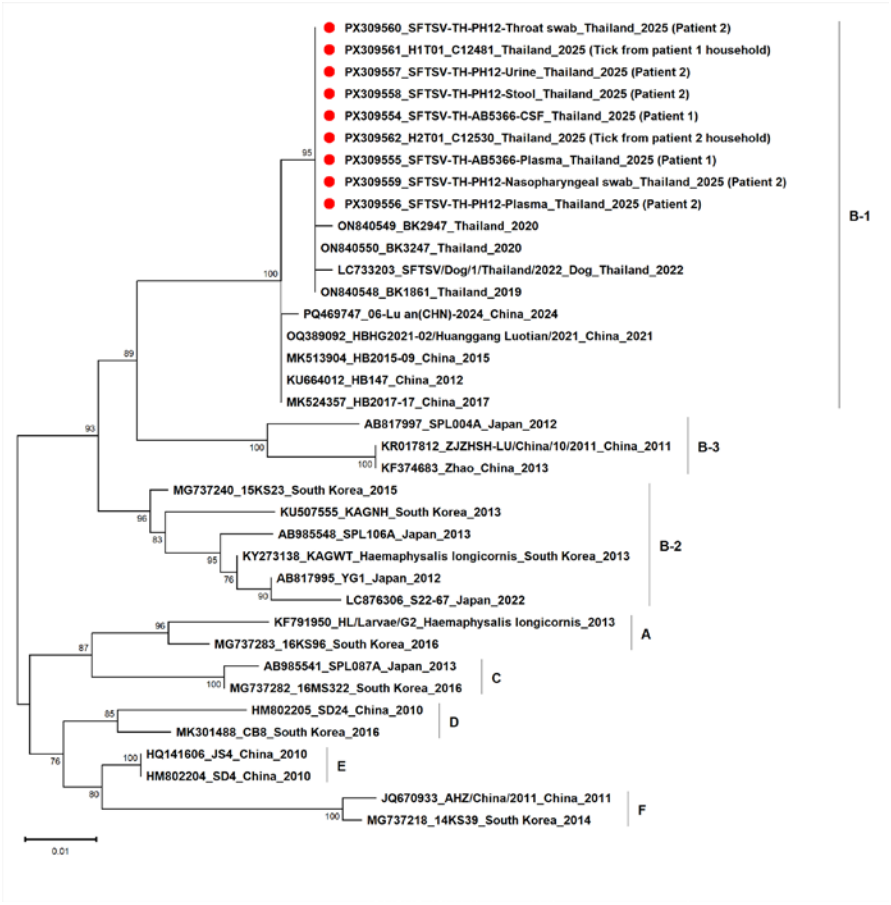
Total ticks tested: 227

- Phitsanulok = 183
- Phetchabun = 44

PCR results:

No SFTSV RNA detected in any tick samples

Maximum likelihood phylogenetic tree of SFTSV based on the partial S segment nucleotide sequences

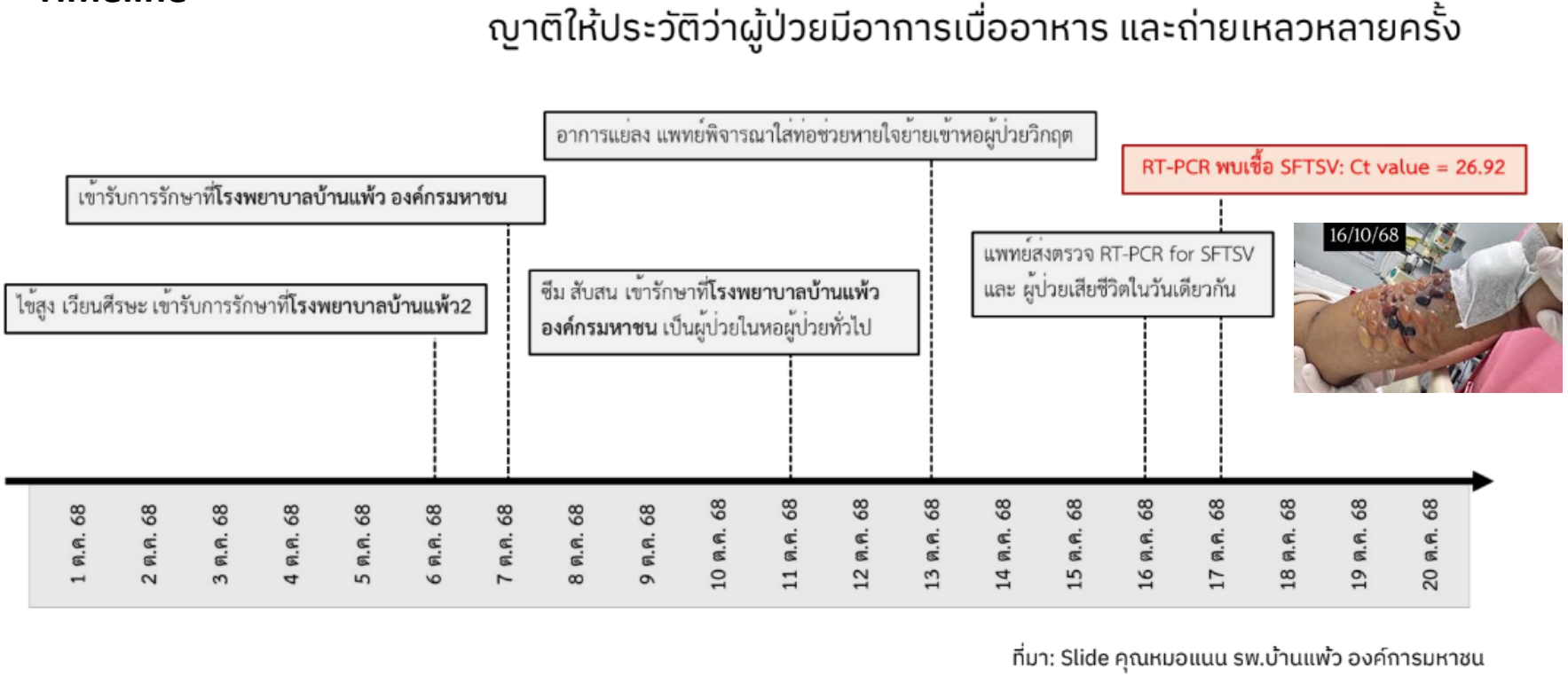


Phylogenetic analysis showed that all sequences obtained in this study (patients and representative tick samples) were identical and clustered within genotype B-1 together with previously reported Thai strains and closely related Chinese strains (2012–2024).

Outbreak of SFTS with Fatal Cases No. 3

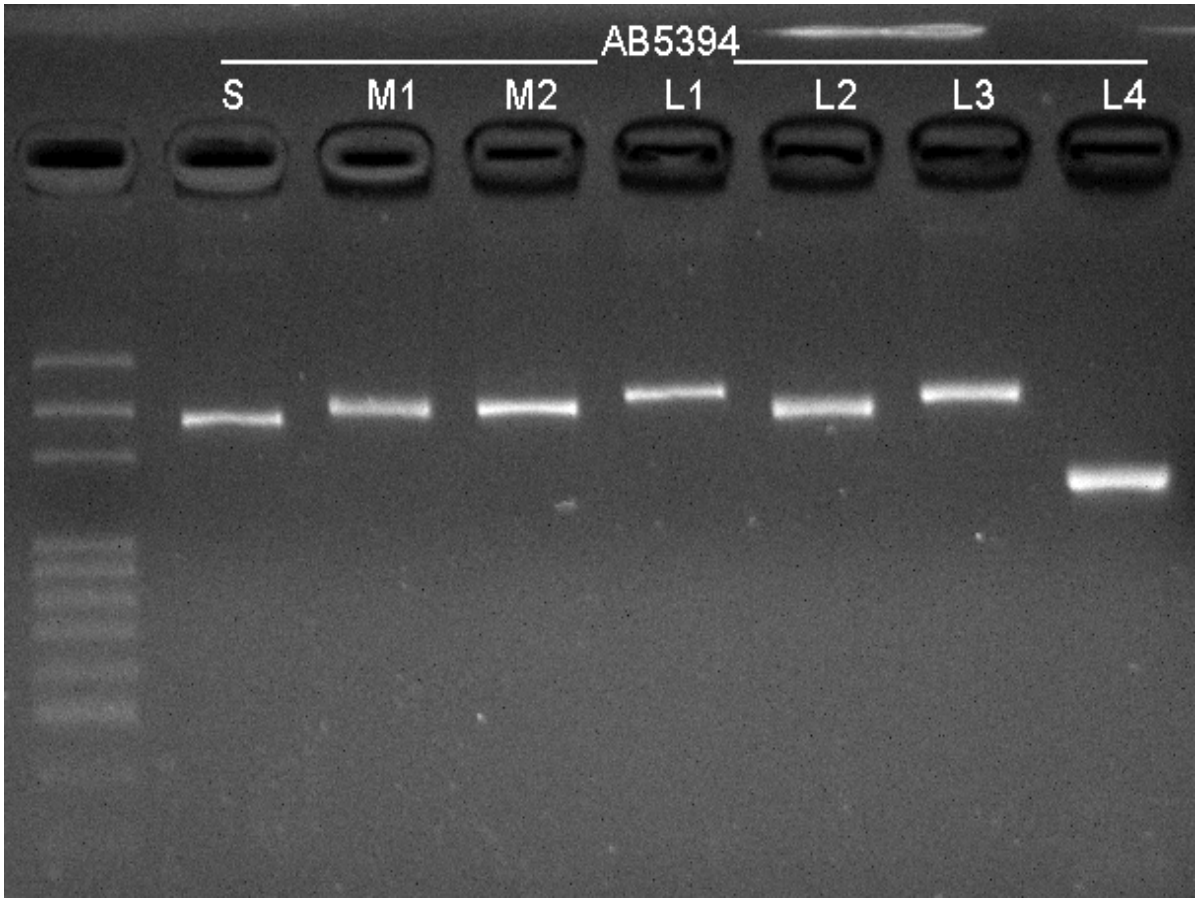
Case 3: 54-year-old Male, Ban Phaeo, Samut Sakhon

Timeline



ที่มา: Slide คุณหมอแนน รพ.บ้านแพ้ว องค์การมหาชน

RT-PCR Amplification of SFTSV Genome Segments (S, M, L) from Patient Sample



S = 1746

M1 = 2041

M2 = 1923

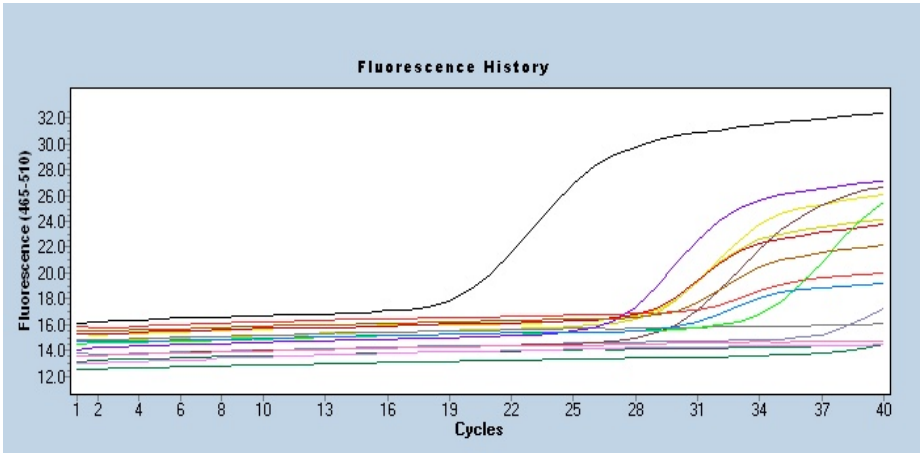
L1 = 2080

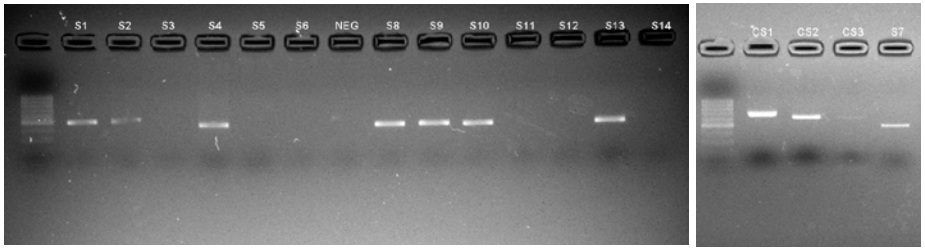
L2 = 1958

L3 = 2055

L4 = 1349

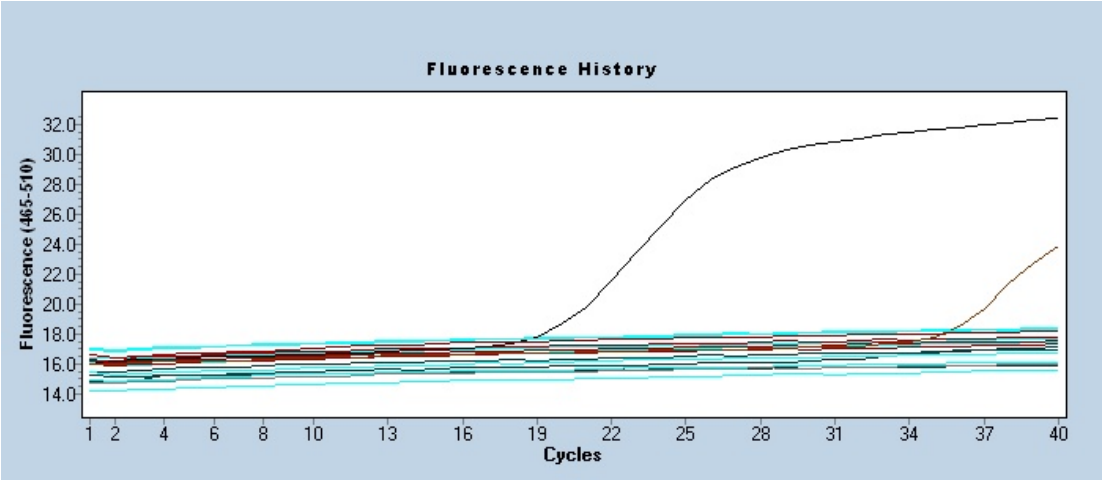
Detection of SFTSV RNA in Multiple Clinical Specimens from Patient No. 3 (Real-Time RT-PCR and Conventional PCR)





S1 = Urine (Ct = 29.31), collection date 13 Oct 2025
S2 = Urine sediment (Ct = 28.68)
S3 = CSF (Ct = 37.87), collection date 11 Oct 2025
S4 = Sputum (Ct = 29.47), collection date 14 Oct 2025
S5 = Hemoculture H665 (Not detected), collection date 15 Oct 2025
S6 = Hemoculture H666 (Not detected), collection date 15 Oct 2025
S7 = Pus for slide (Ct = 31.68), collection date 15 Oct 2025
S8 = Stool (Ct = 30.71), collection date 13 Oct 2025
S9 = Pus from rt ear 1 (Ct = 32.34), collection date 14 Oct 2025
S10 = Pus from rt ear 2 (Ct = 28.99), collection date 14 Oct 2025
S11 = Plasma (Heparin)(Not detected), collection date 14 Oct 2025
S12 = Plasma (Heparin)(Not detected), collection date 15 Oct 2025
S13 = Plasma (EDTA)(Ct = 26.79), collection date 16 Oct 2025
S14 = Plasma (Heparin)(Ct = 33.64), collection date 16 Oct 2025

Screening of Dog and Cat Samples for SFTSV RNA by RT-PCR



Dog No. 11 (Ct = 35.46)

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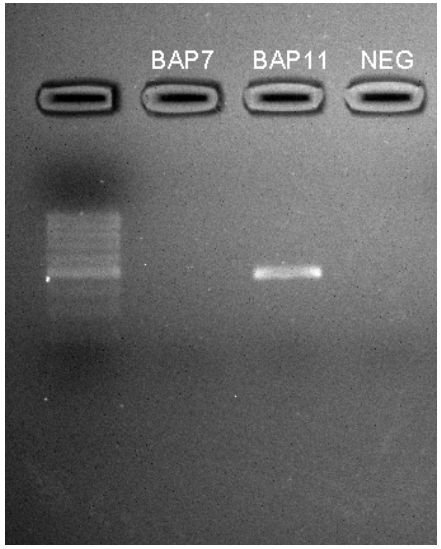

A total of 13 animal samples, including eight dogs and five cats, were tested for the presence of SFTSV RNA using real-time RT-PCR and confirmed by conventional PCR. One dog sample (Dog No. 11) tested positive

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081-8587755

การศึกษาสิ่งแวดล้อมที่พักอาศัยของผู้ป่วย

ช่องทางเดินระหว่างห้อง

พื้นที่รกร้างด้านหลัง

บริเวณตากผ้า

การศึกษาสิ่งแวดล้อมที่พักอาศัยของผู้ป่วย

บ้านดาวรุ่ง/เก่ง[B]

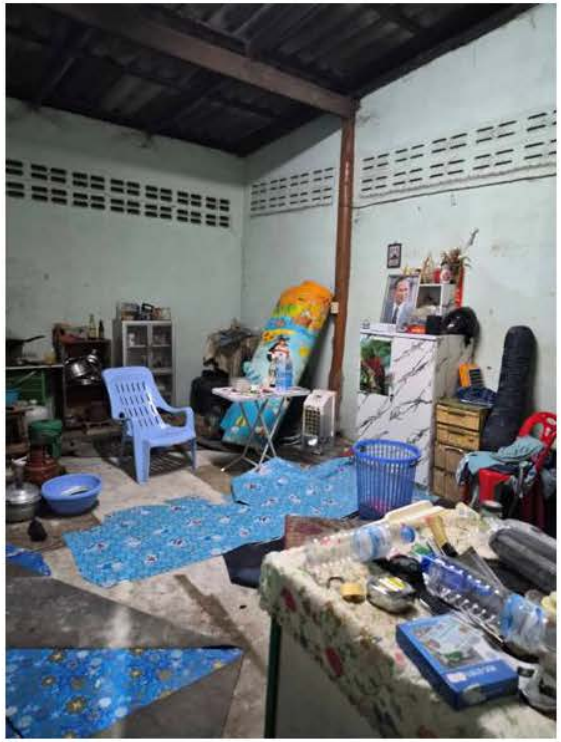
บ้านสมควร[B]

ที่ตากผ้า	16	15	14	13	12	11
3		6	9[A]		10	บ้านคุณยาย
2		5	8		พื้นที่โล่ง	
1[B]		4	7[C]			

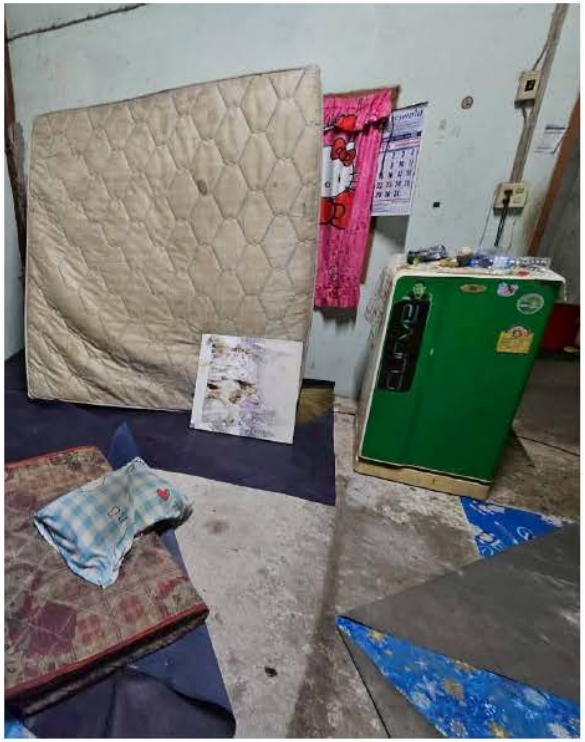
พื้นที่รกร้าง

A = ห้องผู้เสียชีวิต
B = มีประวัติดื่มสุราด้วยกัน + มีโอกาสสัมผัสสุนัขสูง
C = มีประวัติโดยเห็บกัด

การศึกษาสิ่งแวดล้อมที่พักอาศัยของผู้ป่วย



ห้องผู้ป่วย



จุดที่มีเห็บปริมาณมาก

เห็บที่เก็บตัวอย่าง

การศึกษาวัดที่ดำเนินการพิธีศพ

- ลูกสาวผู้เสียชีวิตนำสุนัขมาขังไว้ในกรงใกล้กับศาลาทำพิธีศพ
- พบสุนัขและแมวไม่มีเจ้าของจำนวนมาก โดยเฉพาะบริเวณกุฏิ

Sample collection sheet SFTSV in Dog and Cat ณ วัด ตรงบริเวณศาลา

สมศรี (อยู่ใกล้ชิดกับมุกตลอดเวลา)

Results Summary: SFTSV Detection in Humans and Animals (Ban Phaeo, Samut Sakhon)

Human Samples:

- **Total tested:** 84 serum samples
- **Result:** All samples were **negative (Not detected)** by real-time RT-PCR
- **Interpretation:** No evidence of active SFTSV infection among human participants

Animal Samples:

- **Total tested:** 13 samples
  - Dogs: 8
  - Cats: 5
- **Result: One dog sample** tested **positive** (Ct = 35.46)
- **All other samples:** Negative
- **Confirmation:** Positive dog confirmed by conventional PCR and gel electrophoresis

Sample collection sheet SFTSV in Dog and Cat ณ บ้านพักผู้ป่วย

ถุงทอง

บี้ (สุนัขจร)

บุญรอด

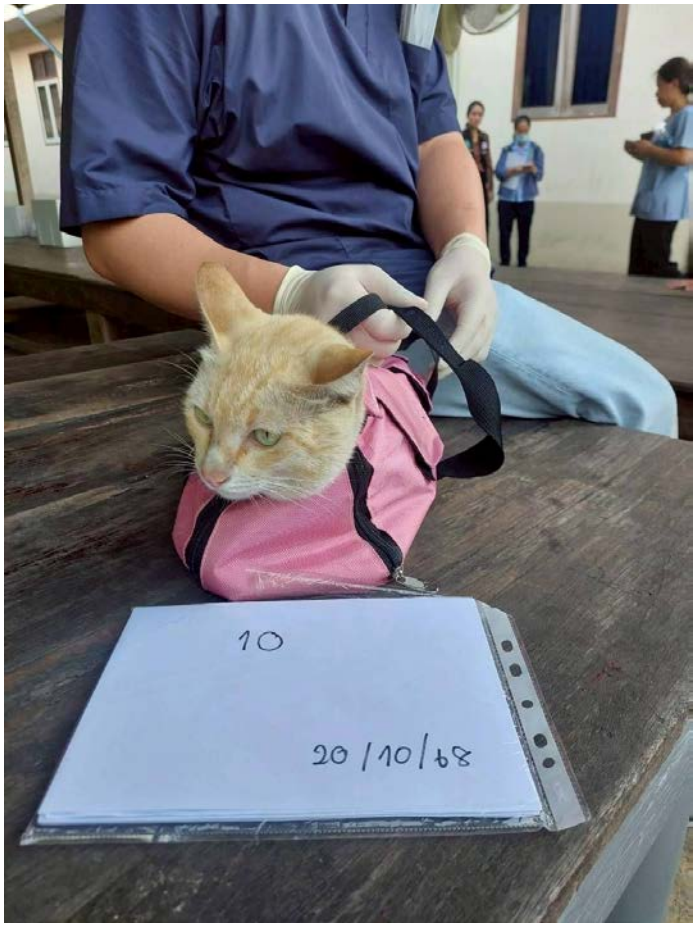
ไทเกอร์

Tick จากในห้องผู้ป่วย

Sample collection sheet SFTSV in Dog and Cat ณ วัด ตรงบริเวณศาลา (หน้าวัด) มีสุนัขอยู่บริเวณนี้ประมาณ 6 ตัว

Sample collection sheet SFTSV in Dog and Cat

ณ วัด ตรงบริเวณกุฏิ มีสุนัขและแมวอยู่รวมกัน



เด็กใหม่

น้องนาง

Sample collection sheet SFTSV in Dog and Cat

ณ ร้านใกล้โรงงาน (บริเวณที่ผู้ป่วยมาทานอาหาร)

ส้ม

ก๋อยจี้

ไฟ

สิ่งที่ดำเนินการไปแล้ว

คน

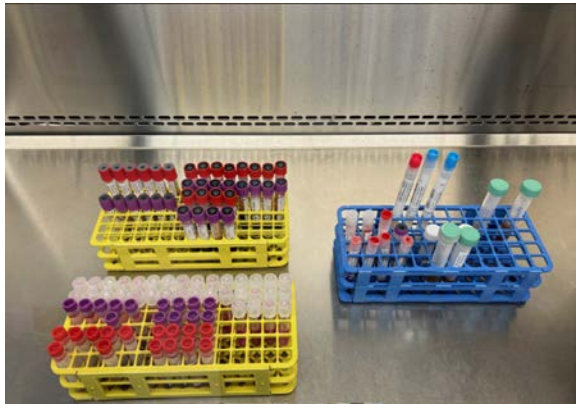
- ดำเนินการเก็บตัวอย่างเลือดผู้สัมผัสใกล้ชิดและผู้ป่วยตามนิยามส่งตรวจทางห้องปฏิบัติการ
- ติดตามผู้สัมผัสใกล้ชิดและผู้ป่วยเพิ่มเติมในชุมชน และสถานพยาบาล

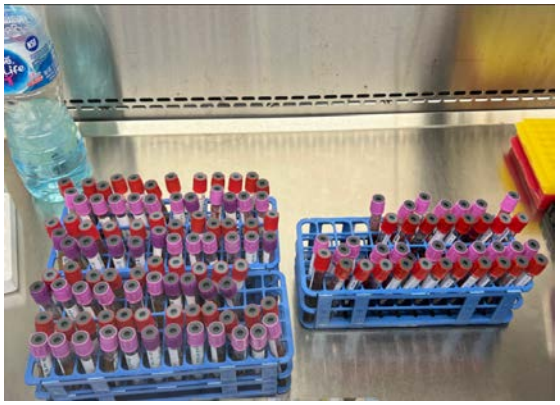
สัตว์

- ดำเนินการเก็บตัวอย่างเลือดสุนัขส่งตรวจทางห้องปฏิบัติการ
- ฉีดยากำจัดเห็บหมัด (Ivermectin) ให้กับสุนัขในบริเวณชุมชน

สิ่งแวดล้อม

- เก็บตัวอย่างเห็บจากห้องเช่าผู้เสียชีวิตและในสุนัขบริเวณชุมชน
- ฉีดพ่นสารเคมีกำจัดแมลง (Cypermethrin) ตามสิ่งแวดล้อมภายในห้องของผู้เสียชีวิต และบริเวณรอบห้องเช่า





Characteristics of specimens positive for SFTSV, Thailand

A

Source	Age	Sex	Collect date Day after the onset of fever	Specimen types	qRT-PCR (Ct value)	RT-PCR	Isolate	GenBank accession no.
Patient 2	54	Male	12	Plasma	26.79	+ve	SFTSV-TH	xxxxxxxxxxx
			9	Urine	29.31	+ve	SFTSV-TH	xxxxxxxxxxx
			7	CSF	37.87	Wkly.+ve	-	
			10	Sputum	29.47	+ve	SFTSV-TH	xxxxxxxxxxx
			10	Pus (Rt. ear)	28.99	+ve	SFTSV-TH	xxxxxxxxxxx
			9	Stool	30.71	+ve	SFTSV-TH	xxxxxxxxxxx
			11	Vascular fluid	31.68	+ve	SFTSV-TH	xxxxxxxxxxx

B

Sample Source	No. Tested	Positive n (%)	Remarks	Specimen types	qRT-PCR (Ct value)	RT-PCR	Isolate	GenBank accession no.
Dogs	18	1 (5.6)	+ve in temple dog	Serum	-	+ve	SFTSV-TH	xxxxxxxxxxx
Cats	5	0	All -ve	Serum	-	-	-	
Ticks	268	6 (2.24)	Adult male (2)	No.1 (neighboring dog)	19.7	-ve	SFTSV-TH	xxxxxxxxxxx
			Adult female (4)	No. 2 (patient's room)	18.64	+ve	SFTSV-TH	Xxxxxxxxxxx
				Patient's room	18.23	+ve	SFTSV-TH	Xxxxxxxxxxx
					33.3	+ve	SFTSV-TH	Xxxxxxxxxxx
					19.39	+ve	SFTSV-TH	Xxxxxxxxxxx
					33.19	+ve	SFTSV-TH	Xxxxxxxxxxx

Summary

Human infections

Confirmed cases, including fatalities. Viral RNA detected in multiple specimens (plasma, CSF, urine, stool, respiratory), showing systemic spread and the need for testing beyond plasma.

Animal reservoirs

Dogs show notable seroprevalence with RNA-positive samples; wild rodents also harbor SFTSV.

Vector ecology

SFTSV detected in dog-associated *Rhipicephalus sanguineus* ticks and chigger mites; tick sequences identical to human strains, indicating a complex zoonotic cycle.

Public health implications

Human cases, animal reservoirs, and competent vectors confirm SFTSV as an emerging threat in Thailand, requiring clinician awareness, multiplex diagnostics, and One Health surveillance.


เพราะงานวิจัย
Transplant Surgery Workshop
เด็กเกิดวันนี้จะมีอายุ 120 ปี

Acknowledgement

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- We thank all staff members of the CE in Clinical Virology for their technical and administrative assistance. Support for S.K. and W.C. was provided by the Second Century Fund (C2F) of CU.
- Investigation, disease control, and specimen collection were collaborated with the DDC, MoPH, Thailand.
- The assistance provided by the Department of Entomology, WRAIR-AFRIMS, for this work was supported by the Global Emerging Infections Surveillance Program.