

Correlation between Scrub Typhus Vectors and Human Cases, Penghu, 2003–2015

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Abstract

We have conducted prevalence surveillance of the etiology of scrub typhus, *Orientia tsutsugamushi*, from rodents and *Leptotrobium* chiggers at 15 locations and same season ten times in Penghu islands during 2003 to 2015. Four species of rodents had been captured, of which *Rattus norvegicus* and *Suncus murinus* are both more commensal with human living environment, the other species *Mus musculus* and *Rattus losea* are all field live rats. In correlation analysis, parameters included total trapped rats, positive number and percentage of rats parasitizing chiggers, number and percentage of chigger pool from individual rat with positive DNA detection of *Orientia tsutsugamushi*, and number of rats with positive *tsutsugamushi* antibody by immunofluorescent assay. All the chiggers collected were diagnosed as *Leptotrobium deliense* in the surveillance. The positive numbers and percentages of rats parasitizing chiggers were well correlated with human scrub typhus cases in Penghu ($r = 0.74$, $p = 0.024$, 0.025). The estimated number human scrub typhus cases in Penghu in 2015 would be 73 with a 95% confidence interval of 43 to 102.

Keywords: *Orientia tsutsugamushi*, Rodent, *Leptotrobium deliense*, Penghu islands

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First Fatal Case of Scrub Typhus, Taiwan, 2016

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Abstract

On May 9, 2016, a 37-year-old female suspected of scrub typhus, dengue virus infection, Q fever and leptospirosis was reported to Taipei Regional Center, Taiwan Centers for Disease Control (TCDC), and she died on the same day. Scrub typhus was later laboratory-confirmed by TCDC. This is the first fatal case of scrub typhus over the past 3 years. Mortality of scrub typhus was low in Taiwan and there has been no death from scrub typhus since 2014. The patient, a foreign tourist, had sought medical help several times after developing symptoms but was not promptly diagnosed and treated. Early diagnosis and treatment is the key to decrease mortality of scrub typhus. Clinical presentations of scrub typhus were similar to many other infectious diseases and it is, nevertheless, difficult to differentiate from other diseases. Clinicians should consider adding scrub typhus into differential diagnosis if one presents unknown fever with outdoor activities. As there are growing numbers of foreign travelers visiting Taiwan, we recommend clinicians collect complete information of TOCC history (Travel, occupation, contact, and cluster) when seeing travelers/foreign visitors with suggestive symptoms.

Keywords: Scrub typhus, Fatal case, Differential diagnosis, TOCC, Travel history

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Numbers of New Cases and Cumulative Cases of Notifiable Infectious Diseases (by week of diagnosis)

Case diagnosis week		Week 37		Week 1–37	
Classification	Disease Diagnosed ¹	2016	2015	2016	2015
Category I	Plague	0	0	0	0
	Rabies	0	0	0	0
	SARS	0	0	0	0
	Smallpox	0	0	0	0
Category II	Acute Flaccid Paralysis	0	0	29	11
	Acute Viral Hepatitis type A	19	7	803	87
	Amoebiasis	6	8	222	263
	Anthrax	0	0	0	0
	Chikungunya Fever	0	0	8	4
	Cholera	0	1	9	7
	Dengue Fever	4	3682	700	13075
	Diphtheria	0	0	0	0
	Enterohemorrhagic E. coli Infection	0	0	0	0
	Epidemic Typhus Fever	0	0	0	0
	Hantavirus Pulmonary Syndrome	0	0	0	0
	Hemorrhagic Fever with Renal Syndrome	0	0	3	1
	Malaria	0	0	7	7
	Measles	0	1	13	28
	Meningococcal Meningitis	0	0	2	2
	Paratyphoid Fever	0	0	5	4
	Poliomyelitis	0	0	0	0
	Rubella	0	0	4	6
	Shigellosis	2	3	147	129
Typhoid fever	0	0	3	22	
West Nile Fever	0	0	0	0	
Category III	Acute Viral Hepatitis type B	0	3	72	91
	Acute Viral Hepatitis type C ⁵	3	6	152	153
	Acute Viral Hepatitis type D	0	0	1	1
	Acute Viral Hepatitis type E	0	0	13	2
	Acute Viral Hepatitis untype	0	0	0	1
	Congenital Rubella Syndrome	0	0	0	0
	Enteroviruses Infection with Severe Complications	2	0	21	4
	Haemophilus Influenza type b Infection	0	0	13	1
	Japanese Encephalitis	0	0	16	28
	Legionellosis	0	3	77	129
	Mumps ²	9	6	409	575
	Neonatal Tetanus	0	0	0	0
	Pertussis	0	3	14	73
	Tetanus ²	0	0	9	7
	Category IV	Botulism	0	0	4
Brucellosis		0	0	0	2
Complicated Influenza		2	7	1864	793
Complicated Varicella ⁴		0	0	30	38
Endemic Typhus Fever		1	0	13	24
Herpesvirus B Infection		0	0	0	0
Invasive Pneumococcal Disease		9	10	425	384
Leptospirosis		8	3	69	58
Lyme Disease		0	0	1	2
Melioidosis		0	1	18	27
Q Fever		0	1	34	32
Scrub Typhus		2	0	322	291
Toxoplasmosis		0	1	8	9
Tularremia		0	0	0	0
Category V	Ebola Virus Disease	0	0	0	0
	Ebola-Marburg Hemorrhagic Fever	0	0	0	0
	Novel Influenza A Virus Infections ⁶	0	0	0	0
	Lassa Fever	0	0	0	0
	Rift Valley Fever	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus	0	0	0	0
Yellow Fever	0	0	0	0	

- The following 8 chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
- Reported cases.
- Since 2014/1/1, "Varicella" was modified to "Complicated Varicella".
- Since 2014/3/6, the case definition for confirmed Acute hepatitis C was changed from "meet the clinical and laboratory conditions" to "meet the clinical or laboratory conditions".
- Since 2014/7/1, various subtypes of human cases of avian influenza are reported as "novel influenza A virus infections", a Category V Notifiable Infectious Disease. The original "H5N1 flu" and "H7N9 flu", which were respectively listed as a Category I Notifiable Infectious Disease and a Category V Notifiable Infectious Disease were removed from the list on the same day.
- Since 2016/1/22, "Zika Virus Infection" was listed as a Notifiable Infectious Disease.

Suspected Clusters

- Seventeen clusters were reported, including 12 diarrhea clusters, 3 upper respiratory tract infection clusters, 1 tuberculosis cluster, and 1 varicella cluster.

Imported Infectious Diseases

- 12 confirmed cases were imported from 5 countries during Week 37 of 2016.

Country Disease	Indonesia	China	Philippines	Japan	Thailand	Total
Shigellosis	3	1				4
Amoebiasis	4					4
Dengue Fever			1		1	2
Hepatitis A		1		1		2
Total	7	2	1	1	1	12

Note: The statistics listed in this table include imported cases that were either confirmed or updated* in the previous week.

- A total of 578 confirmed cases were imported from 36 countries in 2016.
- Top 3 imported diseases : Dengue fever (260), Amoebiasis (109), Hepatitis A (77).
- Top 3 countries responsible for most imported cases : Indonesia (243), Philippines (60), Thailand (57).

Summary of Epidemic

- **Dengue Fever** : The epidemic has increased gradually in Southeast Asian countries. Imported cases have continued to be reported. After Typhoon Meranti lashed Taiwan with torrential rain last week, the occurrence of rain has still promoted mosquito growths and elevated the risk of dengue transmission. New case of dengue has been confirmed. The public is urged to clean up and remove any vector breeding sites and take prevention measures against mosquito bites.
- **Zika Virus Infection** : The epidemic has increased in Singapore, Thailand and Malaysia, elevating the risk of importing Zika virus from these countries.
- **Scrub Typhus** : The epidemic activity remains at its peak and is expected to gradually increase in September and October. The endemic areas are primarily eastern and outlying islands of Taiwan.

● **Enterovirus** : The number of visits to outpatient services and ER for enterovirus infection has increased slightly, and the epidemic is expected to gradually increase. Coxsackie A virus is currently the dominant strain circulating in the community. Sporadic cases of enterovirus 71 infection have been confirmed recently. This year, a total of 139 cases of enterovirus 71 infection, including 20 severe cases and 119 mild cases, have been confirmed. The public is urged to enhance personal hygiene and stay vigilant for suspicious symptoms of enterovirus infection with severe complications in infants.

Numbers of New Cases and Cumulative Cases of Notifiable Infectious Diseases (by week of diagnosis)

Case diagnosis week		Week 38		Week 1—38	
Classification	Disease Diagnosed ¹	2016	2015	2016	2015
Category I	Plague	0	0	0	0
	Rabies	0	0	0	0
	SARS	0	0	0	0
	Smallpox	0	0	0	0
Category II	Acute Flaccid Paralysis	0	1	29	12
	Acute Viral Hepatitis type A	28	3	831	90
	Amoebiasis	1	6	223	269
	Anthrax	0	0	0	0
	Chikungunya Fever	0	0	8	4
	Cholera	0	0	9	7
	Dengue Fever	5	4376	705	17451
	Diphtheria	0	0	0	0
	Enterohemorrhagic E. coli Infection	0	0	0	0
	Epidemic Typhus Fever	0	0	0	0
	Hantavirus Pulmonary Syndrome	0	0	0	0
	Hemorrhagic Fever with Renal Syndrome	0	1	3	2
	Malaria	4	0	11	7
	Measles	0	0	13	28
	Meningococcal Meningitis	1	0	3	2
	Paratyphoid Fever	0	0	5	4
	Poliomyelitis	0	0	0	0
	Rubella	0	0	4	6
	Shigellosis	7	5	154	134
	Typhoid fever	0	0	3	22
West Nile Fever	0	0	0	0	
Category III	Acute Viral Hepatitis type B	4	2	76	93
	Acute Viral Hepatitis type C ⁵	5	4	157	157
	Acute Viral Hepatitis type D	0	0	1	1
	Acute Viral Hepatitis type E	0	0	13	2
	Acute Viral Hepatitis untype	0	0	0	1
	Congenital Rubella Syndrome	0	0	0	0
	Enteroviruses Infection with Severe Complications	1	0	22	4
	Haemophilus Influenza type b Infection	0	0	13	1
	Japanese Encephalitis	2	0	18	28
	Legionellosis	1	4	78	133
	Mumps ²	29	11	438	586
	Neonatal Tetanus	0	0	0	0
	Pertussis	2	1	16	74
	Tetanus ²	0	0	9	7
Category IV	Botulism	1	0	5	2
	Brucellosis	0	0	0	2
	Complicated Influenza	5	5	1869	798
	Complicated Varicella ⁴	2	0	32	38
	Endemic Typhus Fever	0	1	13	25
	Herpesvirus B Infection	0	0	0	0
	Invasive Pneumococcal Disease	11	9	436	393
	Leptospirosis	5	3	74	61
	Lyme Disease	0	0	1	2
	Melioidosis	2	1	20	28
	Q Fever	4	2	38	34
	Scrub Typhus	12	14	334	305
	Toxoplasmosis	0	0	8	9
Tularremia	0	0	0	0	
Category V	Ebola Virus Disease	0	0	0	0
	Ebola-Marburg Hemorrhagic Fever	0	0	0	0
	Novel Influenza A Virus Infections ⁶	0	0	0	0
	Lassa Fever	0	0	0	0
	Rift Valley Fever	0	0	0	0
	Middle East Respiratory Syndrome Coronavirus	0	0	0	0
Yellow Fever	0	0	0	0	

1. The following 8 chronic diseases are excluded from the table: MDR-TB, Tuberculosis, Syphilis, Gonorrhoea, HIV Infection, AIDS, Hansen Disease and Creutzfeldt-Jakob Disease.
2. Reported cases.
3. Since 2014/1/1, "Varicella" was modified to "Complicated Varicella".
4. Since 2014/3/6, the case definition for confirmed Acute hepatitis C was changed from "meet the clinical and laboratory conditions" to "meet the clinical or laboratory conditions".
5. Since 2014/7/1, various subtypes of human cases of avian influenza are reported as "novel influenza A virus infections", a Category V Notifiable Infectious Disease. The original "H5N1 flu" and "H7N9 flu", which were respectively listed as a Category I Notifiable Infectious Disease and a Category V Notifiable Infectious Disease were removed from the list on the same day.
6. Since 2016/1/22, "Zika Virus Infection" was listed as a Notifiable Infectious Disease.

Suspected Clusters

- Fifteen clusters were reported, including 5 diarrhea clusters, 5 varicella clusters, 2 upper respiratory tract infection clusters, 2 tuberculosis clusters, and 1 influenza-like illness cluster.

Imported Infectious Diseases

- 15 confirmed cases were imported from 6 countries during Week 38 of 2016.

Country Disease	Gambia	Indonesia	Philippines	Vietnam	Japan	India	Total
Dengue Fever		1	2	2			5
Malaria	4						4
Amoebiasis		2	1				3
Shigellosis		1				1	2
Hepatitis A					1		1
Total	4	4	3	2	1	1	15

Note: The statistics listed in this table include imported cases that were either confirmed or updated* in the previous week.

- A total of 593 confirmed cases were imported from 37 countries in 2016.
- Top 3 imported diseases : Dengue fever (265), Amoebiasis (112), Hepatitis A (78).
- Top 3 countries responsible for most imported cases : Indonesia (247), Philippines (63), Thailand (57).

Summary of Epidemic

- **Dengue Fever** : The epidemic has increased gradually in Southeast Asian countries. Imported cases have continued to be reported. After Typhoons Meranti, Malakas and Megi lashed Taiwan with torrential rain these past two weeks, the occurrence of rain has still promoted mosquito growths and elevated the risk of dengue transmission. The public is urged to clean up and remove any vector breeding sites and take prevention measures against mosquito bites.
- **Zika Virus Infection** : The epidemic has increased in Singapore, Thailand and Malaysia, elevating the risk of importing Zika virus from these countries.
- **Scrub Typhus** : The number of cases reported has decreased. The epidemic activity remains at its peak and is expected to gradually increase in September and October. The endemic areas are primarily eastern and outlying islands of Taiwan.

- **Enterovirus** : The number of visits to outpatient services and ER for enterovirus infection has increased, and the epidemic is expected to gradually increase. Coxsackie A virus is currently the dominant strain circulating in the community. Sporadic cases of enterovirus 71 infection have been confirmed recently. This year, a total of 141 cases of enterovirus 71 infection, including 20 severe cases and 121 mild cases, have been confirmed. The public is urged to enhance personal hygiene and stay vigilant for suspicious symptoms of enterovirus infection with severe complications in infants.
- **Leptospirosis and Melioidosis** : After Typhoon Megi lashed Taiwan, the residents in affected areas are at risk of leptospirosis and melioidosis transmission and the epidemic activity is expected to gradually increase.

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