

## Just the Facts...

*Scrub typhus is a form of typhus caused by a rickettsial bacteria known as Orientia tsutsugamushi. O. tsutsugamushi is transmitted by the bite of infected, immature mites (chiggers) primarily of the genus Leptotrombidium. The illness also goes by other names, including mite-borne typhus, Japanese river fever, tropical typhus, and tsutsugamushi disease. The name "tsutsugamushi" derives from two Japanese words: "tsutsuga", meaning something small and dangerous, and "mushi", meaning creature. The disease is most often referred to as "scrub typhus" because it occurs most commonly after exposure to areas of scrubby vegetation.*

### How does a person get scrub typhus?

You can get scrub typhus if you are bitten by a chigger that is infected with *O. tsutsugamushi*. The bacteria are found throughout the body of the chigger, although the highest concentration is present in the salivary glands. When an infected chigger feeds on a host (human or other animal), the bacteria are transmitted to the host.

### Do all mites transmit scrub typhus?

No. Most human cases of scrub typhus are acquired from *Leptotrombidium akamushi* and *L. deliense* (or other trombiculid mites depending on the geographic location). In addition, only the larval life stage (chigger) of *Leptotrombidium* transmits the disease, since the other life stages (nymph and adult) do not feed on vertebrate animals. *Leptotrombidium* mites act as the primary reservoirs for *O. tsutsugamushi*. Once they are infected in nature by feeding on the blood of infected rodents (especially rats, moles, and mice), they maintain the infection throughout all their life stages and, as adults, pass the infection on to their eggs in a process called transovarial transmission. In this way, *Leptotrombidium* mite populations can autonomously maintain their infectivity over long periods of time. Rodents become infected when infected mites feed on them, and they act as secondary reservoir hosts when they, in turn, infect naïve (uninfected) mites.



Photo: AFRIMS

Ventral view (underside) of the larval stage (chigger) of a *Leptotrombidium* mite, the vector of scrub typhus

### How prevalent is scrub typhus?

Scrub typhus does not occur in the United States, except for cases in travelers who have visited endemic areas. The disease is present in southeastern Asia, including Pakistan, Afghanistan, Korea, and Thailand; Japan and the Philippines; eastern China and southeastern Russia; India; and northern Australia, Indonesia, and the islands of the southwestern Pacific. The distribution within these locations can be highly focal, and infected foci, known as "mite islands" or "typhus islands" can persist for years. Infected mites have been found in sites as varied as subarctic regions, seashores, mountains up to 10,000 feet, rain forests, river banks, semiarid deserts, rice paddies, and urban areas. Scrub typhus was first described from Japan in 1899. During World War II, scrub typhus killed or incapacitated thousands of troops fighting in rural or jungle areas of the Pacific theater (5,441 cases with 283 deaths among U.S. Army personnel), was a suspected leading cause of fevers of unknown origin (FUOs) in U.S. forces during the Vietnam conflict, and caused two confirmed cases among U.S. troops during the Korean War. Two outbreaks of scrub typhus occurred among U.S. marines training at Camp Fuji, Japan in 2000 and 2001.

### What are the symptoms of scrub typhus?

Following an incubation period of 6-21 days (mean, 10-12 days) after the bite of an infected chigger, symptoms usually begin suddenly. Initial symptoms can include moderate to high fever, severe headache, shaking chills, fever, cough, conjunctivitis (inflammation of the mucous membranes lining the eyes), and lymphadenopathy (swollen lymph nodes). An ulcer is seen at the bite site, which begins as a small (0.5 inches) flat lesion. Within a few days, it becomes elevated, ruptures and fills with fluid, then becomes covered with a black scab (eschar). Scarring may result. Within a week after infection, a secondary red spotted rash develops on the trunk, and may extend over the arms and legs. The rash can remain



Photos: LTC R. Likeman, Australian Defence Force<sup>1</sup>

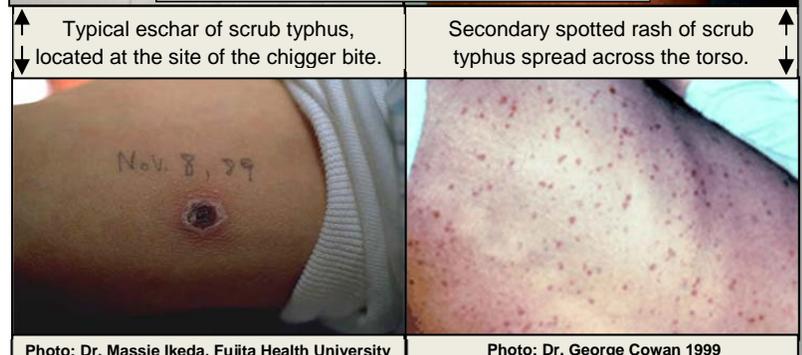


Photo: Dr. Massie Ikeda, Fujita Health University

Photo: Dr. George Cowan 1999

flat and fade away within a few days, or become raised and intensely colored. During the second week, if untreated, additional symptoms can include splenomegaly (enlargement of the spleen), lung infection (especially pneumonia), myocarditis (inflammation of the heart muscle), increased pulse rate, severe drop in blood pressure, delirium, loss of consciousness, and death by the end of the second week. Mortality in untreated cases ranges from 1% to 60% depending on virulence of the strain of bacteria, immunological profile/age of the victim, and previous exposure to the bacteria (infection can confer varying degrees of immunity).

### How is scrub typhus diagnosed?

In addition to physical symptoms, blood tests are used to diagnose scrub typhus. The immunofluorescent antibody test is the most frequently used serological technique.

### What is the treatment for scrub typhus?

Doxycycline is the antibiotic of choice, although chloramphenicol is equally effective when tetracycline drugs are contraindicated. With prompt and proper treatment, deaths are rare and recovery is usually rapid and without complications.

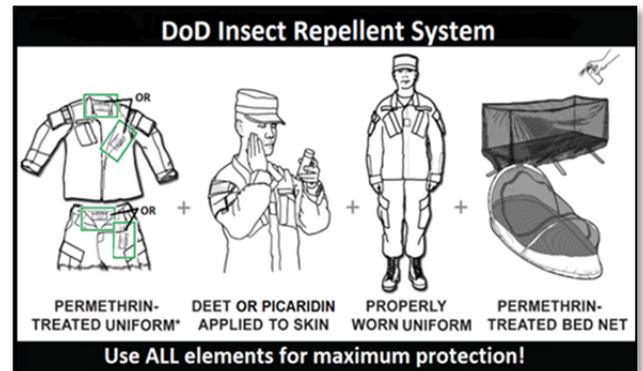
### What can I do to reduce my risk of becoming infected with scrub typhus?

There is no vaccine to protect against scrub typhus. Therefore, help prevent scrub typhus, and other insect-borne diseases, by protecting yourself from chiggers. When in endemic areas, follow these precautions:

- Wear proper clothing as a physical barrier against chiggers – long pants tucked into boots or tightly-woven socks; long sleeve shirt; and shirt tucked into pants. Avoid walking barefoot; don't wear open-toed shoes or sandals.
- Use both skin and clothing repellents that have been approved by the Environmental Protection Agency (EPA). They are safe and effective.

- For your skin, use a product that contains 20-50% **DEET** (N,N-diethyl-meta-toluamide). **DEET** in higher concentrations is no more effective.
- Use **DEET** sparingly on children, and don't apply to their hands, which they often place in their eyes and mouths.
- Apply **DEET** lightly and evenly to exposed skin; do not use underneath clothing. Avoid contact with eyes, lips, and broken or irritated skin.
- To apply to your face, first dispense a small amount of **DEET** onto your hands and then carefully spread a thin layer.
- Wash **DEET** off when your exposure to ticks, mosquitoes, and other arthropods ceases.
- For your clothing, use a product that contains **permethrin**. **Permethrin** is available commercially as 0.5% spray formulations. Clothing that is factory-impregnated with permethrin may also be purchased commercially.
- Permethrin** should only be used on clothing, never on skin.
- When using any insect repellent, always FOLLOW LABEL DIRECTIONS.
- Do not inhale aerosol formulations.

- For optimum protection, soldiers should utilize the **DOD INSECT REPELLENT SYSTEM**. In addition to proper wear of the field uniform (ACUs, BDUs, DCUs)(pants tucked into boots, sleeves down, undershirt tucked into pants), this system includes the concurrent use of both skin and clothing repellents:



- Standard military skin repellent: 33% **DEET** lotion, long-acting formulation, one application lasts up to 12 hours, **NSN 6840-01-284-3982**.
- Standard military clothing repellents: either aerosol spray, 0.5% **permethrin**, one application lasts through 5-6 washes, **NSN 6840-01-278-1336**; or impregnation kit, 40% **permethrin**, one application lasts the life of the uniform (at least 50 washes), **NSN 6840-01-345-0237**. Factory permethrin-treated ACUs are also available via contract [Contact the Armed Forces Pest Management Board (AFPMB) for details, DSN 295-7476; CM (301) 295-7476; <http://www.afpmb.org>]

- Do not sit or lie on bare ground or on grass or other vegetation; always use a ground cover, preferably one that has been treated with permethrin repellent.
- Clear scrubby vegetation and keep grass short; when other methods fail, and as necessary, apply insecticides that are registered by the EPA for use against mites.
- Keep rodents and other animals out of camping and bivouac areas. Practice good food hygiene to discourage scavengers.
- Shower vigorously to remove chiggers.
- Launder uniform and other clothing regularly.
- Take chemoprophylactic antibiotic pills if prescribed by a medical authority. Doxycycline administered as a single oral 200 mg dose once a week for seven weeks has been shown to offer some protection.<sup>2</sup>

<sup>1</sup> Likeman, R., LTC. Scrub typhus: a recent outbreak among military personnel in North Queensland. Australian Defence Force Health. April 2006; 7(1):10-13.

<sup>2</sup> Devine, J. A review of scrub typhus management in 200-2001 and implications for soldiers. J. Rural and Remote Environ. Health. 2003; 2(1):14-20.