



## Geographical Distribution, Effect of Season & Life Cycle of Scrub Typhus

Parag Sharma, Rakesh Kakkar, Shilpa.N.Kaore, Vijay. K. Yadav, Raj Sharma

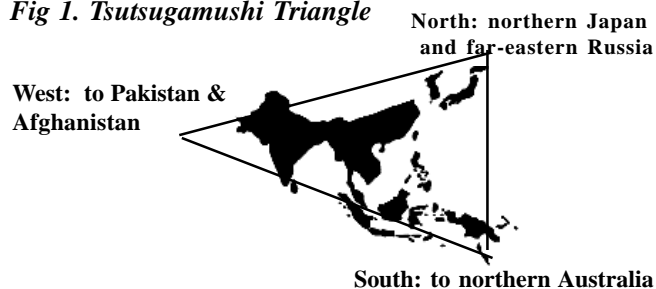
### Introduction

Scrub typhus is an infectious disease caused by *Orientia tsutsugamushi*, a tiny parasite about the size of bacteria that belongs to the family Rickettsiaceae. Scrub typhus was first described by Hashimoto from Japan in 1899 (1). The term scrub is used because of the type of vegetation (terrain between woods and clearings) that harbours the vector; however, the name is not entirely correct because certain endemic areas can also be sandy, semi-arid and mountain deserts (2,3).

It is reported most often from Southeast Asia and Japan and is the most commonly reported rickettsial infection in India. Globally over one billion people are at risk for scrub typhus and an estimated one million cases occur annually (1). Scrub typhus is also known as tsutsugamushi disease. The name tsutsugamushi is derived from two Japanese words: tsutsuga, meaning something small and dangerous, and mushi, meaning creature. The infection is called scrub typhus because it generally occurs after exposure to areas with secondary (scrub) vegetation. It has recently been found, however, that the disease can also be prevalent in such areas as sandy beaches, mountain deserts, and equatorial rain forests.

Therefore, it has been suggested that the names mite-borne typhus, or chigger-borne typhus, are more appropriate. Since the disease is limited to eastern and southeastern Asia, India, northern Australia and the adjacent islands, it is also commonly referred to as tropical typhus

Fig 1. Tsutsugamushi Triangle



Scrub typhus is endemic to a part of the world known as the "tsutsugamushi triangle" (Fig 1.), which extends from northern Japan and far-eastern Russia in the north, to

northern Australia in the south, and to Pakistan and Afghanistan in the west (4). The disease is largely limited to Southeastern and Eastern Asia, Northern Australia, India, Pakistan, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Ceylon and other islands in the region. In India, it is present in whole of the Shivalik ranges from Kashmir to Assam, Eastern and Western Ghats and the Vindhya and Satpura ranges in the central part of India. There were reports of scrub typhus outbreaks in Himachal Pradesh, Sikkim and Darjeeling (West Bengal) during 2003-2004 and 2007. Outbreaks of scrub typhus are reported in southern India during the cooler months of the year (5). Scrub typhus is a re-emerging infectious disease in India. The distribution of the disease corresponds with the distribution of *Leptotrombidium deliense* and *Leptotrombidium akamushi*. The vector mite is now known to be present in diverse ecological niches such as equatorial rain forests, semi deserts and Alpine subarctic terrains in the Himalayan regions. Endemic foci are usually associated with specific habitats such as abandoned plantations, gardens or rice fields, overgrown forest clearings, shrubby fringes of fields and forests, river banks and grassy fields. These ecological patches which attract the natural host of mite vectors are called "mite islands". Within the mite islands there may be a limited area of intensive transmission of rickettsiae called "Typhus Island". During the rainy season, several cases of acute febrile illness of unknown origin occurred. Two new genotypes of *O. tsutsugamushi* were identified in the region (6,7).

**Agent:** *Orientia tsutsugamushi* is the agent of scrub typhus in India. It differs from other rickettsiae in its antigenic structure. At least eight serotypes are recognized.

**Vector:** The infection is transmitted through the larval mites or "chiggers" belonging to the family Trombiculidae, genus and subgenus *Leptotrombidium*. Only the larval stage takes a blood meal (6).

**Host:** A number of small rodents particularly wild rats of subgenus *Rattus* are the natural hosts for scrub typhus (1). The rodents and acarine hosts do not succumb to the disease. Thus the field rodents and the vector mites act as

From the Peoples College of Medical Sciences and Research Center, Bhanpur, Bhopal (M.P.)-462037 India

Correspondence to : Dr Parag Sharma, Assistant Professor, PCMS & RC, Bhopal, MIG-11, PDA campus, Bhanpur, Bhopal (M.P.)-462037

a reservoir and between the two the infection perpetuates in nature. The migration of infested or infected rodents leads to establishment of new foci of disease (6).

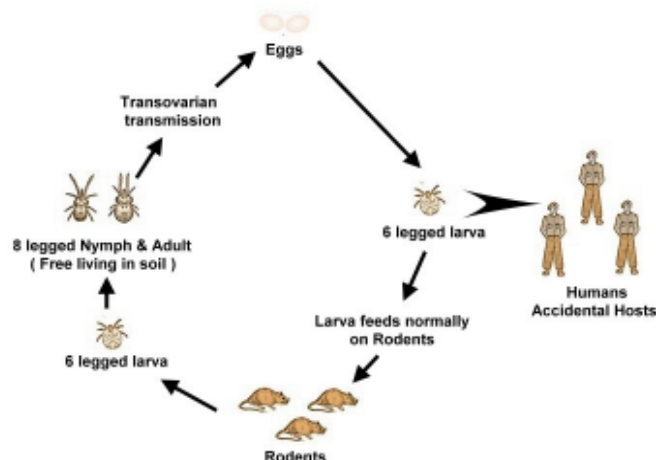
#### Effect of Season (5)

Before 1986, scrub typhus was only found endemic in southern China. Because human infections typically occur in the summer, it is called "summer type". During the autumn-winter period of 1986, a new type of scrub typhus was identified in Shandong and northern Jiangsu province of northern China. This newly recognized scrub typhus was subsequently reported in many areas of northern China and was then called "autumn-winter type". The autumn-winter type scrub typhus in northern China occurred exclusively from September to December with a peak occurrence in October, which was different from the summer type in southern China. In comparison with the summer type, complications associated with autumn-winter type scrub typhus were less severe, and abnormalities of routine hematological parameters were less obvious (7). However, clinical characteristics of associated cases have not been reported. The seasonal occurrence of scrub typhus varies with the climate in different countries. It occurs more frequently during the rainy season. However, outbreaks have been reported during the cooler season in southern India. Certain areas such as forest clearings, riverbanks, and grassy regions provide optimal conditions for the infected mites to thrive. These small geographic regions are high-risk areas for humans and have been called scrub-typhus islands.

**Incubation Period:** The incubation period of scrub typhus is about 6 to 21 days (6) (mean, 10-12 days) after the initial bite.

#### Transmission & Life Cycle (Fig-2)

The infection is transmitted to man and rodents by some species of infective trombiculid mites ("chiggers", *Leptotrombidium deliense* and others) which feeds on lymph and tissue fluid rather than blood. The mite is very small (0.2 - 0.4mm) and can only be seen through a microscope or magnifying glass (7). Once they are infected in nature by feeding on the body fluid of small mammals, including the rodents, they maintain the infection throughout their life stages and, as adults, pass the infection on to their eggs in a process called transovarian transmission. Similarly, the infection passes from the egg to the larva or adult in a process called transtadial transmission. In this way, chigger mite populations can autonomously maintain their infectivity over long periods of time (6,7). Rather than biting or piercing the skin, mite larvae prefer to insert their mouthparts down hair follicles or pores. A large numbers of the *Orientia tsutsugamushi* are present in the salivary glands of the larvae and these are injected into its host when it feeds (7). The bite of the mite leaves a characteristic black eschar that is useful to the doctor for making the diagnosis (7). Human



**Fig 2. Life Cycle of *Orientia Tsutsugamushi***

infection takes place when man accidentally picks up an infective larval mite while walking, sitting, or lying on the infested ground. The adult mites have a four-stage lifecycle: egg, larva, nymph and adult. The larva is the only stage (chigger) that can transmit the disease to humans and other vertebrates, since the other life stages (nymph and adult) do not feed on vertebrate animals. Both the nymph and the adult are free-living in the soil (6,7).

#### Conclusion

Scrub typhus is widely endemic in a geographically confined area of the Asia-Pacific region, the so-called tsutsugamushi-triangle. Scrub typhus is endemic in the tropical and subtropical regions of the Asian continent. It is also an important cause of acute undifferentiated febrile illnesses in India. The disease also show seasonal variations. Thus, knowledge of geographic distribution, effect of season and life cycle of the disease shall help health care providers to recognize and control disease in better way.

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