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Scrub Typhus: An Emerging Public Health Concern During the Monsoon in Telangana

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Scrub typhus is an emerging yet frequently overlooked zoonotic disease that has become an important cause of seasonal fever in many parts of India, including Telangana. Caused by the intracellular bacterium *Orientia tsutsugamushi* and transmitted through the bite of infected larval trombiculid mites (chiggers), the disease mainly occurs during the monsoon and post-monsoon months when environmental conditions favor the survival of mites and their rodent hosts. Farmers, livestock owners, veterinarians, forest workers and people living close to vegetation are particularly vulnerable because of their frequent exposure to mite-infested habitats. Since the early symptoms resemble dengue, malaria, leptospirosis, typhoid, and other viral fevers, scrub typhus often remains undiagnosed until serious complications develop. Fortunately, the disease responds remarkably well to appropriate antibiotics when recognized early. Increasing awareness among healthcare professionals, veterinarians, and the general public, along with strengthening surveillance and adopting a One Health approach, can substantially reduce illness and mortality associated with this neglected tropical disease (Kelly *et al.*, 2009; Varghese *et al.*, 2021).

Keywords: Scrub typhus, *Orientia tsutsugamushi*, Telangana, Chigger mite, Zoonosis, One Health, Rickettsial disease

Introduction

The southwest monsoon is vital for agriculture in Telangana, but it also increases the risk of several vector-borne and zoonotic diseases. While illnesses such as dengue and malaria receive considerable public attention, **scrub typhus** remains an under-recognized yet important cause of seasonal fever. In recent years, it has emerged as a significant contributor to **acute undifferentiated febrile illness** across many Indian states, including Telangana, particularly during the monsoon and post-monsoon months (ICMR, 2023). Scrub typhus is caused by *Orientia tsutsugamushi*, an obligate intracellular bacterium transmitted through the bite of infected **chigger mites**, the larval stage of trombiculid mites. These microscopic mites inhabit grassy fields, scrub vegetation, forest margins and rodent-infested areas, placing farmers, livestock handlers, veterinarians, and rural communities at increased risk of exposure (CDC, 2024). The disease often presents with non-specific symptoms such as fever, headache, muscle pain, and fatigue, making it difficult to distinguish from dengue, malaria, typhoid, leptospirosis, and other tropical infections. This overlap frequently delays diagnosis, allowing the infection to progress to complications involving the lungs, liver, kidneys, heart, or brain. Nevertheless, scrub typhus is highly responsive to antibiotics such as doxycycline or azithromycin, and most patients recover rapidly when treatment is initiated early. Improving awareness, encouraging early diagnosis, and promoting preventive measures are therefore essential to reducing the disease burden in Telangana.

Global Distribution and Disease Burden

Scrub typhus is traditionally endemic within the **"Tsutsugamushi Triangle,"** a vast region extending from northern Japan and eastern Russia through China, Southeast Asia, the Indian subcontinent and northern Australia. Nearly **one billion people** reside in this endemic zone and remain at risk of infection (Kelly *et al.*, 2009). Although once considered geographically restricted, recent reports have identified scrub typhus and closely related *Orientia* species in parts of the Middle East, South America, and Africa, suggesting a broader global distribution than previously recognized (Xu *et al.*, 2017). In India, the number of reported cases has increased over the past two decades, largely due to improved diagnostic facilities, enhanced disease surveillance, greater clinical awareness and changing environmental conditions. Seasonal outbreaks are now regularly reported from several states, including Himachal Pradesh, Uttarakhand, Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, Telangana, Odisha, Assam and Meghalaya, highlighting scrub typhus as an emerging public health concern (Varghese *et al.*, 2021).

Why Telangana is Increasingly Vulnerable

Telangana possesses several environmental and occupational factors that favour the transmission of scrub typhus. The state's tropical climate, seasonal rainfall, extensive cultivation of paddy, cotton, maize, and pulses, along with large tracts of scrub vegetation and forest fringes, create ideal habitats for chigger mites and rodents. During the monsoon months (July to November), vegetation becomes dense and humidity remains high, allowing mite populations to multiply rapidly. Farmers spend long hours in fields harvesting crops, weeding or tending livestock, increasing the likelihood of accidental contact with infected chiggers. Similarly, veterinarians, livestock inspectors, forest personnel, shepherds, and wildlife workers frequently enter environments where infected mites are abundant. Surveillance studies from Telangana have identified scrub typhus as a significant cause of **acute febrile illness**, particularly during the post-monsoon season. Districts such as Adilabad, Nizamabad, Karimnagar, Jagtial, Warangal, Mulugu, Bhadradri Kothagudem, and Khammam have repeatedly reported cases. Although disease occurrence varies from year to year, seasonal clusters continue to challenge clinicians because the illness closely resembles other common tropical infections. Rapid urbanization, changing land-use patterns, increased human encroachment into forest ecosystems and climatic fluctuations are believed to further influence the ecology of chigger mites and rodent hosts. These environmental changes highlight the need for continuous surveillance and early warning systems.

The Causative Agent: *Orientia tsutsugamushi*

The Causative Agent

Scrub typhus is caused by *Orientia tsutsugamushi*, an obligate intracellular bacterium that survives and multiplies only within living host cells. It primarily infects the **vascular endothelial cells** lining blood vessels, resulting in **vasculitis**, a hallmark of the disease. The resulting inflammation and vascular damage can impair blood flow to multiple organs, including the lungs, liver, kidneys, heart, and central nervous system, leading to a wide range of clinical manifestations. A distinctive characteristic of *O. tsutsugamushi* is its marked antigenic diversity. Multiple strains, including **Karp, Gilliam, Kato, Kawasaki, and Boryong**, circulate in endemic regions. This extensive strain variation poses a major challenge to vaccine development and explains why immunity following natural infection is often incomplete and short-lived, allowing reinfection with different strains (Kelly *et al.*, 2009).

How Does Infection Occur?

The transmission cycle of scrub typhus involves three key components: **chigger mites, wild rodents, and *Orientia tsutsugamushi***. Small mammals, particularly field rats and shrews, act as reservoir hosts, while chigger mites serve as both the **vector and natural reservoir** of the bacterium. The infection is maintained within mite populations through **transovarial**

transmission (from infected female mites to their offspring) and **transstadial transmission** (across developmental stages), allowing the organism to persist without continuous mammalian infection. Only the **larval stage (chigger)** feeds on humans and other warm-blooded animals. These microscopic larvae (<0.2 mm) are commonly found in grassy fields, scrub vegetation, forest margins, and agricultural lands. During outdoor activities, chiggers attach to exposed skin, particularly around the waist, groin, axillae, ankles, and behind the knees. Rather than burrowing into the skin, chiggers release digestive enzymes that dissolve superficial tissues and feed on the resulting tissue fluids. During feeding, *O. tsutsugamushi* is inoculated into the host, and the bite site may later develop into the characteristic **eschar**. Humans are **accidental (dead-end) hosts** and person-to-person transmission does not occur under natural conditions (Kelly *et al.*, 2009; CDC, 2024).

Pathogenesis: How a Tiny Bite Leads to Severe Disease

Following the bite of an infected chigger, *Orientia tsutsugamushi* multiplies locally at the site of inoculation, often producing a characteristic **eschar**. The organism then spreads through the lymphatic system and bloodstream, invading the endothelial cells lining blood vessels. This results in **systemic vasculitis**, increased vascular permeability and impaired blood flow, ultimately affecting multiple organs. Consequently, severe cases may develop complications such as **acute respiratory distress syndrome (ARDS), hepatitis, myocarditis, acute kidney injury, meningoencephalitis** and **multiple organ dysfunction syndrome**. Disease severity varies with the infecting strain, bacterial load, host immune response, age, and underlying health conditions. Early antibiotic therapy limits bacterial multiplication and significantly reduces disease progression (Kelly *et al.*, 2009).

Clinical Manifestations: Recognizing the Warning Signs

The clinical presentation of scrub typhus is often non-specific, making early diagnosis challenging. After an incubation period of **6–21 days** (usually 10–12 days), patients typically develop **high-grade fever**, chills, severe headache, myalgia, fatigue and loss of appetite. Because these symptoms resemble dengue, malaria, typhoid, leptospirosis, and other tropical infections, scrub typhus is frequently overlooked during the initial stages (Varghese *et al.*, 2021). As the illness progresses, patients may experience persistent body aches, dry cough, nausea, vomiting, abdominal pain, lymph node enlargement, and occasionally a **maculopapular rash**. A characteristic finding is the **eschar**—a painless black scab surrounded by an erythematous margin at the site of the chigger bite. It commonly occurs in concealed areas such as the groin, axillae, waistline, neck folds, beneath the breasts, or behind the knees. Although highly suggestive of scrub typhus, an eschar is identified in only **7–68%** of Indian patients; therefore, its absence does not exclude the disease (Xu *et al.*, 2017). Without timely treatment, progressive vascular injury can lead to life-threatening complications, including **ARDS, myocarditis, hepatitis, acute kidney injury, meningoencephalitis, disseminated intravascular coagulation (DIC), septic shock** and **multiple organ dysfunction syndrome**. Mortality may reach **30–40%** in untreated severe cases but declines to **less than 5%** with early diagnosis and appropriate antibiotic therapy (CDC, 2024; Kelly *et al.*, 2009).

Diagnosis: Early Recognition is Critical

Early diagnosis of scrub typhus depends on **clinical suspicion**, history of exposure, and laboratory confirmation. During the monsoon season, patients with **persistent fever** following exposure to agricultural fields, scrub vegetation, forests or rodent-infested areas should be evaluated for scrub typhus (ICMR, 2023). Routine laboratory findings may include **thrombocytopenia, leukocytosis or leukopenia, elevated liver enzymes (AST/ALT), increased C-reactive protein (CRP), and mild renal impairment**. Although non-specific, these findings support the diagnosis in the appropriate clinical setting. **IgM ELISA** is the most commonly used diagnostic test because it is affordable and reliable. **Indirect Immunofluorescence Assay (IFA)** is the gold standard, while **Polymerase Chain Reaction**

(PCR) is particularly useful during the early stage of illness before antibodies develop. Although less accurate, the **Weil–Felix (OXK)** test may still be used where advanced diagnostic facilities are unavailable (ICMR, 2023). Because scrub typhus closely resembles dengue, malaria, typhoid, leptospirosis, COVID-19 and other febrile illnesses, a **high index of suspicion** is essential for early diagnosis and prompt treatment.

Treatment: Prompt Therapy Prevents Complications

Scrub typhus responds rapidly to appropriate antibiotic therapy, and treatment should begin **as soon as the disease is clinically suspected**, without waiting for laboratory confirmation in endemic areas. **Doxycycline** is the first-line treatment for most adults and older children, with clinical improvement usually occurring within **24–48 hours**. **Azithromycin** is preferred for pregnant women, young children and patients who cannot receive doxycycline. **Chloramphenicol** and **rifampicin** may be considered in selected cases, although rifampicin should be avoided in patients with suspected tuberculosis because of the risk of antimicrobial resistance. Supportive care—including adequate hydration, antipyretics, oxygen therapy, correction of electrolyte imbalance and intensive care when required—is vital for patients with severe disease or multi-organ involvement. Early diagnosis combined with prompt antibiotic treatment remains the most effective strategy for reducing complications and mortality associated with scrub typhus (CDC, 2024; ICMR, 2023).

Prevention: Reducing Exposure to Chigger Mites

At present, **no licensed vaccine** is available against scrub typhus because the bacterium exhibits extensive antigenic diversity, making vaccine development extremely challenging. Consequently, prevention focuses on reducing exposure to infected chigger mites. Individuals working in agriculture, forestry, livestock farming, wildlife management and rural development should wear **full-sleeved clothing, long trousers, socks, and boots** while entering grassy or scrub-infested areas. Clothing treated with **permethrin** and the use of insect repellents containing **DEET** provide additional protection against mite bites. After returning from outdoor work, people should bathe promptly, wash clothing thoroughly and inspect their bodies for attached chiggers, particularly in skin folds and areas where clothing is tight. Avoiding prolonged sitting or sleeping directly on grass also reduces exposure. Environmental management is equally important. Clearing excessive vegetation around houses, maintaining clean surroundings, reducing rodent populations, and minimizing the accumulation of weeds around livestock sheds decrease suitable habitats for chigger mites. Community participation in sanitation and vegetation management can substantially reduce disease risk.

Telangana: Strengthening Preparedness

The ecological and climatic conditions of Telangana continue to favour seasonal transmission of scrub typhus. Climate variability, expanding agriculture, urbanization, and increasing human contact with natural habitats may further enhance the risk of disease occurrence. Strengthening laboratory diagnostic facilities, ensuring the availability of rapid diagnostic tests, and training healthcare professionals to recognize scrub typhus at an early stage should remain public health priorities. Community awareness programmes targeting farmers, livestock owners, school children, and rural households can promote early healthcare seeking and reduce delays in diagnosis. Timely surveillance, early recognition, and coordinated action under the **One Health** framework are essential to minimize the impact of scrub typhus and improve preparedness for future seasonal outbreaks.

Conclusion

Scrub typhus has emerged as an important yet frequently overlooked cause of acute febrile illness in Telangana. Despite its potentially severe complications, the disease remains highly curable when recognized early and treated promptly. Increasing public awareness, strengthening disease surveillance, improving diagnostic capacity, and encouraging timely medical consultation are essential steps toward reducing disease burden. The veterinary

profession has an important role in educating rural communities and promoting environmental management under the One Health framework. As climate change, ecological disturbances, and human encroachment continue to influence vector distribution, coordinated action among medical, veterinary and public health sectors will become increasingly important. A simple message deserves emphasis: **during the monsoon season, every persistent fever should prompt consideration of scrub typhus. Early recognition can save lives.**

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