



SCRUB TYPHUS DISEASE OUTBREAK AT CHEURAL VILLAGE, LAWNGTLAI DISTRICT, MIZORAM, NORTH-EAST INDIA

Lalfakzuala Pautu*^{1,2}, Pachuau Lalmalsawma¹, Vanramliana², Gabriel Rosangkima²,
Yogesh Malvi¹, Hunropuia²

¹Integrated Disease Surveillance Programme, Health & Family Welfare Department, Mizoram, India

²Department of Life Sciences, Pachhunga University College, Mizoram University, Mizoram, India

*Corresponding author: mafaka@pucollege.edu.in

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ABSTRACT

Scrub typhus, which is one of the rickettsial diseases, is an acute, febrile illness in men caused by the pathogen, 18 a gram-negative bacterium *Orientia tsutsugamushi* from the bite of infected mite. Outbreaks of scrub typhus have been reported from various parts of North, South, and Eastern India. There was a report of two unfortunate death cases from Cheural village due to scrub typhus at Lawngtlai district hospital. While, multiple cases, having symptoms like scrub typhus illness were also reported by health officials of the residents of Cheural village, Lawngtlai District, Mizoram. Among the 242 person tested, 80 (33.05%) person were found reactive with Weil felix PROGEN OXK at 1:160 titre value. Maximum numbers of cases were observed among the working age group 20-60 years. Among the different occupational groups, farmers were the most affected as more than 90% of the villagers were involved in forest farming. The five captured rodents' sera were also tested with Weil felix. All of the captured rodent sera were reactive with one or more antigen. Mites (chigger) were also collected from the rodent samples and the chigger index was found to be 19.2. This study indicated that scrub typhus and other rickettsial diseases were responsible for the outbreak. The extremely high chigger index with reactivity rate reactivity rate of Weil felix with sera of captured rodents strongly indicated the household transmission of scrub typhus and other rickettsial diseases in the outbreak village.

Keywords: Outbreak, Rickettsial disease, Rodent, Scrub typhus, Weil felix test.

1. INTRODUCTION

A rickettsial disease which is commonly known as scrub typhus is an acute, febrile illness in men caused by the pathogen, a gram-negative bacterium *Orientia tsutsugamushi* (Family: *Rickettsiaceae*) from the bite of infected mites (chigger) [1, 2]. About 50% of cases with undifferentiated febrile illness in many parts of the country especially during cooler season were due to scrub typhus disease [3]. Outbreaks of scrub typhus have been reported from various parts of North, South, and Eastern India [4]. Nevertheless, diagnosis of scrub typhus is a major challenge in India due to the limited access to laboratory tests [4, 5]. Prevalence of the disease has been reported from different parts of India including states like, Jammu Kashmir, Tamil Nadu, Bihar, Karnataka, Maharashtra, Kerala, Himachal Pradesh, Andhra Pradesh, Sikkim, Rajasthan, Meghalaya, Uttaranchal, Mizoram and West Bengal [6-14].

Rickettsial infection can be diagnosed with the Weil Felix (WF) agglutination test. Antibodies produced against rickettsial infection in man cross reacts with the antigenic epitopes of *Proteus species* of the Weil felix test. PROGEN OXK strain of *Proteus mirabilis* cross reacts with sera from scrub typhus patients and it is used in the diagnosis of *O. tsutsugamushi*-related infections. Other advance techniques like Immuno fluorescence assay, Enzyme Immuno assay, Complement fixation test, Radialimmuno assay and Micro immuno fluorescence are used for the detection of rickettsial diseases [15-17].

There had been a report of two (2) unfortunate death cases from Cheural village due to scrub typhus at Lawngtlai district hospital. At the same time, multiplecases, having symptoms like scrub typhus illness were also reported by health officials among the residents of Cheural village which is under Sangau PHC, Lawngtlai District, Mizoram. In response to this, Director of

Health Service detailed State Rapid Response Team consisting of epidemiologist, entomologist and other supporting staff to investigate the outbreak and to perform other necessary public health activities at Cheural village. The State RRT reach the destination on December 10, 2019 and operated public health actions with Medical Officer and Staff of Sangau PHC from December 11, 2019.

1.1. Outbreak Village Information

The Cheuralvillage located in Sangau Block, Lawngtlai district, Mizoram, India. It extends between 22.72133°N and 93.02622°E. As per 2011 census, 1060 people are living in this village, 528 are males and 532 are females. People living in Cheural depend on multiple skills, most of the people are depending on agricultural farming practices [18].

2. MATERIAL AND METHODS

Free clinic was organized for the villagers at Community hall, Cheural village with assistance from Medical Officer and Staff from Sangau PHC which was followed by public awareness campaign at Cheural community hall on the prevention, vectors, Symptoms, treatment and control of the disease. For this study, the whole village was subdivided into four areas and grouped as area north (N), east (E), west (W) and south (S). In this outbreak 242 patients having symptom of scrub typhus from four areas were screened with Weil-Felix PROGEN OXK antigen test. Several rodent traps were also laid at household area of the locality in order to ascertain the probability of local transmission of the disease within the village from the household rodents. In the next day, retrieval of rodent traps with captured rodents and testing of rodent serum samples were performed by entomologist at Sangau PHC laboratory. In this study Weil felix cutoff titre was fixed at 1:80 dilution for rodents and 1:160 for human as cut off value 1:80 or more were considered for the presumptive case of Rickettsiosis [18]. Captured rodents were identified individually by using taxonomical keys [19, 20]. Captured rodents were also observed under stereo microscope for the presence of mites and other ectoparasites. Chigger index was also calculated by dividing number of chiggers present in the rodents with total number of rodents collected. Chigger index more than the critical chigger index (0.69) was regarded as a factor for scrub typhus disease outbreaks [21]. All activities performed during this outbreak were a public health response from Integrated Disease Surveillance

Programme, Health & Family Welfare Department, Mizoram, India for the surveillance and containment of the disease outbreak. However, the team had obtained ethical approval from the concerned ethical committee.

2.1. Weil felix Test Kit utilised and titre value calculation

The commercial name of test kit utilised was 'PROGEN', Proteus antigen suspensions for Weil felix test manufactured by Tulip Diagnostics (P) LTD. Gitanjali, Tulip block, Dr. Antonio Do Rego Bagh, Altosantacruz, Bambolim complex, P.O., Goa, India. The reagent consists of PROGEN OXK, PROGEN OX19 and PROGEN OX2. The smooth, killed stained PROGEN antigen suspensions are mixed with patient's serum. Antibodies produced due to Rickettsial infection if present will react with the stained PROGEN to produce agglutination reaction. Atigen suspensions of PROGEN OX19 reacts strongly with sera of patients with typhus group Rickettsiae and Rocky Mountain Spotted Fever. PROGEN OX2 antigen suspensions react strongly with sera of patients with Spotted fever infections, while the PROGEN OXK antigen suspensions reacts strongly with sera of patients with scrub typhus.

As per the manufacturer instruction, 1 drop of reagent (PROGEN OXK, OX19 or OX2) which is equivalent to 50 µl (microlitre) will be mixed with 40µl, 20µl, 10µl, 5µl and the corresponding titre will be 1:40, 1:80, 1:160 and 1:320 respectively (Extracted from manufacturer manual attached to the test kit).

During this outbreak investigation study, human sera were tested with PROGEN OXK only due to the emergency of the situation and time limitation, while rodent sera were tested with PROGEN OXK, OX19 and OX2.

The data were analyzed using Student's *t*-test and one-way ANOVA with Tukey's multiple comparisons as post-hoc analysis (OriginPro 8 SRO v8.0724 (B724), Northampton, MA, USA) at a statistical significance level of $p < 0.05$.

3. RESULTS AND DISCUSSION

3.1. Weil-Felix PROGEN OXK test result

Among the 242 person tested, 80 (33.05%) person were found reactive with Weil felix PROGEN OXK at 1:160 titre value. The reactivity rate was relatively high and was 7.44% from the total population of Cheural village which was 1060 as per 2011 census. Among the positive

patients, there were 45 females and 35 males and the mean age was 40 years while mean cases were 8.88.

Maximum number of cases was observed among the working age group 20-60 years (Table 1). Correlation analysis revealed that there was a positive relationship between age of the patient and scrub typhus cases tested with Weil-Felix ($p < 0.05$, $r = 0.7288$) (Table 1).

Fever was the most common symptom which was followed by body ache and headache (Fig. 1) eschar was not observed during this investigation. Statistical analysis of present study showed that there is a significant difference between incidence of various symptoms (One-way analysis of variance, $p \leq 0.05$) (Table 2).

Among the different occupational groups, Farmers were the most affected as more than 90% of the villagers were involved in forest farming. Other members in the community were also highly affected (Fig. 2). It has been observed that people from rural areas who are engaged in agriculture sectors are generally at higher risk of getting infection and females are more vulnerable to the disease than males [21, 22] which is supported by the current finding. The result of present study also revealed that there is significant difference among scrub typhus cases in different occupational groups (One-way analysis of variance, $p \leq 0.05$) (Table 3).

Table 1: Age-wise distribution of cases

Age group	No. of positive cases
0 - 10	8
11 - 20	4
21 - 30	15
31 - 40	18
41 - 50	11
51 - 60	17
61 - 70	6
71 - 80	1

Table 2: Distribution of symptoms among participants of Cheural village

Symptoms	N	E	W	S	Total
Fever	14	16	15	18	63
Bodyache	9	9	11	12	41
Headache	8	9	11	8	36
Cold	4	3	3	4	14
Rash	1	1	1	1	4
Diarrhea	1	1	1	0	3

N = North, E = East, W = West, S = South (sub division of Cheural village for this study)

Table 3: Occupation-based distribution of cases among patients of Cheural village

Occupation	N	E	W	S	Total
Farmer	9	9	12	12	42
House keeper	3	4	3	2	12
Student	3	2	3	3	11
Self employed	2	2	3	3	10
Govt. employee	1	1	0	1	3
Minor	1	0	0	1	2

N = North, E = East, W = West, S = South (sub division of Cheural village for this study)

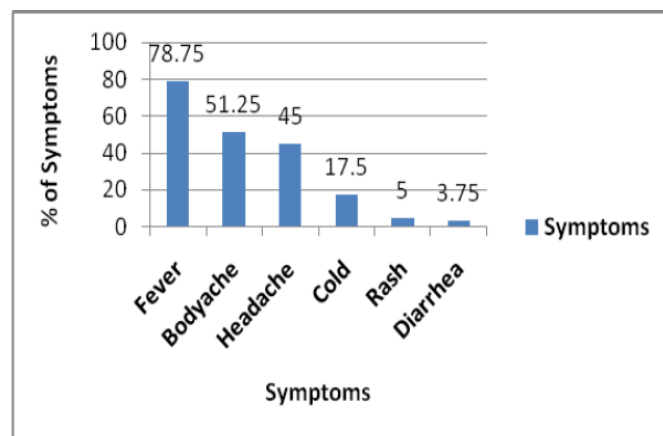


Fig. 1: Graph representing percentage of the distribution of symptoms among participants of Cheural village.

Case distribution among different occupations (%)

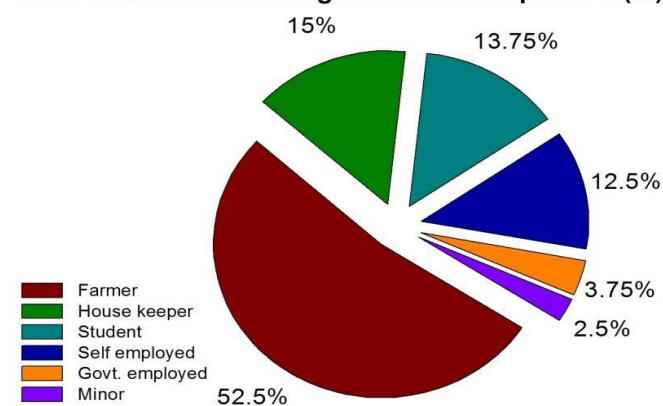


Fig. 2: Pie diagram showing Occupation-based percentage distribution of cases among participants of Cheural village

3.2. Entomological observation and prevalence of diseases in rodent serum

The 5 captured rodents' sera were tested with Weil felix PROGEN OXK, OX19 and OX2. All of the 5 captured

rodent sera were reactive with one or more antigen. Mites (chigger) were also observed and collected from the rodent samples and the chigger index was found to be

19.2. The chigger index by far exceeds the critical chigger index (0.69) for scrub typhus disease outbreaks [21].

Table 4: Rodent sera test result and chigger index

Rodent species	Reactivity with weil-felix test antigens			No. of Mites (chigger)
	OXK	OX19	OX2	
<i>Rattus tanezumi</i>	Positive	Positive	Positive	19
<i>Rattus rattus</i>	Positive	Positive	Positive	8
<i>Rattus tanezumi</i>	Positive	Positive	Positive	26
<i>Rattus rattus</i>	Negative	Negative	Positive	11
<i>Rattus tanezumi</i>	Positive	Negative	Negative	32
Chigger index				19.2

3.3. Possible environment and other factors affecting Rickettsial diseases outbreak

3.3.1. Flowering of bamboo

It was observed that, certain species of bamboo with a botanical name of *Dendrocalamus longispatus* are getting flowering in many parts of Mizoram. The seeds produced by the flowering of bamboo are very nutritious and play an important role in the upsurge of rodent population.

3.3.2. High Rodent infestation

It was observed that the outbreak village was highly infested with rodents. This was due to the practice of storing food grains and other eatable things inside the houses in rural areas. However, capturing rodent with traps was very difficult.

4. CONCLUSION

During this investigation, human sera were tested with Weil felix PROGEN OXK only, among the 245 suspected patients' sample tested, 80 patients were found to be reactive which indicated that scrub typhus disease was responsible for the outbreak. However, there were many suspected patients who showed symptoms but whose samples were non-reactive with the PROGEN OXK. Among the 5 rodent sera examined, all the samples were reactive with any one or all of PROGEN OXK, OX19 or OX2 which showed that scrub typhus with other rickettsial diseases (spotted fever group and typhus group) were present among the household rodents at Cheural village. Due to this reason, it can be assumed that rickettsial diseases other than scrub typhus will also be transmitted among the people of Cheural village. As the vector of scrub typhus disease, chigger (mite) index was also found to be 19.2 which was extremely higher than the critical index of

0.69, the possibility of scrub typhus outbreak was very high in the study area. Due to the high reactivity of sera and high vector, chigger index found among the household rodents, people of the village may not only get infected from forested area but also from their houses (local transmission). Patients who were not reactive with PROGEN OXK but having symptoms were also given scrub typhus treatment.

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Conflict of interest

None

Source of funding

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