



AkiNik

ISSN 2320-7078

JEZS 2013; 1 (6): 27-29

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Received 03-11-2013

Accepted: 09-11-2013

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Entomological surveillance for rodent and their ectoparasites in Scrub Typhus affected areas of Meghalaya, (India)

Abhay Kumar Sharma**ABSTRACT**

In order to ascertain the prevalence of rodent and their arthropod ectoparasites association in the scrub typhus affected areas of Shillong and surrounding areas in Meghalaya (India) present study was undertaken. During the surveillance the rodent species encountered in order of their prevalence were Mole species, *Suncus murinus*, *Rattus rattus*, *Bandicota indica* and *Mus musculus*. A total 66 vector larval trombiculid mite chigger (*Leptotrombidium deliense*) was collected from the rodents giving an overall chigger index as 1.80. Chigger infestation rate was found to be 4.8. In addition, a total of 62 fleas were also retrieved giving an overall flea index as 1.44 which is above critical index of one and requires anti-flea measure in the area. For serological study rodent serum samples were collected for detection of *Orientia* (Scrub typhus) and plague antibodies and all samples were found to be negative. For bacteriological investigations organ impression smear and organ of rodents (heart, liver, lung, and spleen) were collected in culture medium and no sample could show any plague bacilli activity or isolation of *Yersinia pestis*. Results of the study suggest regular and continuous surveillance for rodent and their ectoparasites to monitor the activity of plague bacilli and scrub typhus vector so as to institute early control measures if needed.

Keywords: Scrub Typhus, *Bandicota indica*, *Xenopsylla cheopis*, *Leptotrombidium deliense*, Meghalaya, India.

1. Introduction

Rodents are one of the most successful groups of mammals and have been able to exploit a wide variety of habitats and environments throughout the world. These rodents are able to transmit vector more than 60 known diseases and the list grows as more research on zoonosis continues. Some examples of such diseases are plague, leptospirosis, salmonellosis, rat-bite fever, leishmaniasis, Chagas' disease, Omsk hemorrhagic fever, murine typhus and Lassa fever^[1] Crimean Congo Hemorrhagic fever^[2-3]. Scrub typhus, also known as tsutsugamushi disease is medically significant rodent-borne zoonotic disease and transmitted to humans and rodents by some species of trombiculid mites^[4]. First case of scrub typhus in Meghalaya was reported by a local news paper, the Khasi Daily "U Mawphor" on 30th November, 2005. After that state surveillance unit of Integrated Disease Surveillance Project (IDSP) reported 395 cases and 19 deaths during 2005 to 2011 (Table 1). The state has become now endemic for scrub typhus reporting cases and deaths every year. In order to ascertain the prevalence of rodent – vector mite association a team of experts from the National Centre for Diseases Control (NCDC) visited scrub typhus affected areas of Shillong in Meghalaya during August 2011 with the following objectives:

- (i) To undertake joint Rodent / vector mite surveillance in the areas reported scrub typhus cases earlier.
- (ii) To detect the evidence of *Orientia*/plague antibodies in rodent population if any.
- (iii) To provide onsite training to IDSP and state health officials in surveillance work of vector mite.

The findings of the study are presented in this communication.

2. Material and Methods**2.1 Geographical information on study area**

Meghalaya is made of the oldest rocks-formations consists of the Garo, Khasi and Jaintia

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hills along with their outliers formed by the Assam ranges and Meghalaya's elevation varies between 150 meters to 1961 meters above sea level. The climate of Meghalaya is moderate but humid with average annual rainfall as high as 1200 cm in some areas. Meghalaya is the wettest state of India. The Shillong area, with the highest elevations, experiences generally low temperatures. The maximum temperature in this region rarely goes beyond 28 degrees, whereas winters temperatures of sub-zero degrees are common. The town of Cherrapunji in the Khasi Hills south of capital Shillong holds the world record for most rain in a calendar month, while the village of Mawsynram, near town of Cherrapunji, holds the distinction of seeing the heaviest yearly rains.

Meghalaya is basically an agricultural state the major crop plants of Meghalaya are paddy, maize, millets, pulses, potato, jute and mesta, ginger, turmeric, black pepper, sugar cane, and oil seeds. Rice is the dominant food grain crop accounting for over 80% of the food grain production in the state. The important fruits currently grown in the state include citrus fruits, pineapple, papaya, banana etc. In addition to this, a large variety of vegetables are grown in the state including cauliflower, cabbage and radish.

2.2 Area visited

Following areas in and around Shillong were visited with IDSP and state health officials and selected for the studies:

- i. Bara Bazar, Shillong
- ii. Bara Bazar (Sweeper Colony), Shillong
- iii. St. Paul's Seminary, Shillong
- iv. Panjabi Lane Market, Shillong
- v. Pariong PHC (West Khasi Hills)
- vi. Markasa PHC (West Khasi Hills)
- vii. Myllien (West Khasi Hills)

2.3 Rodent collection, identification and dissection

Rodents were collected using live traps. The traps were set at

pre-selected sites in the study area. Traps were baited with fried foods (Pakora & chappati) smeared with butter. Checking of traps was done early in the next morning. Rodents collected were transported to laboratory and were anaesthetized/identified after recording their different morphological characteristics. Blood serum from rodents was collected to detect *Orientia* (Scrub typhus) and plague antibody using Weil Felix test and plague antibody test^{15, 61}. Dissection of rodents were done to collect organs (Heart, Lung, liver and spleen) in culture (KB) medium for isolation of *Yersinia pestis* and contact organs impression smears of heart, lung, liver and spleen were fixed for identification of plague bacilli. These serological and bacteriological studies were carried out at Zoonosis Division (NCDC).

2.4 Ectoparasites collection, preservation, mounting and identification

The ectoparasites were collected by combing the rodents against the fur of rodents over a white tin pan. Mites, lice and fleas were collected by this method and flea index was calculated. Occasionally forceps were used for tick collection. All ectoparasites were preserved in 70% alcohol. All preserved ectoparasites, excluding ticks, were later mounted using clearing, dehydration and mounting procedure for identification using the standard method described earlier by Kaushal *et al.*¹⁷¹. Fleas and mites were mounted in Hoyer's medium. Mounted slides were then incubated at 40 °C for a week. Ticks were identified directly under microscope.

3. Results and Discussion

A total of 157 traps were laid in the selected areas to trap the rodents. The overall traps positivity rate was recorded as 24.8 per cent. Locality wise trap positivity, ectoparasites (mite, flea, tick and lice) retrieved from the trapped rodents are given in the Table 2.

Table 2: Results of rodent / ectoparasites survey carried out in and around Shillong, Meghalaya

S. No.	Place/ Locality	No. of traps Used	Traps +ve (Percent)	Rodent species						Ectoparasites Collected (No. of Rodent +ve)			
				B.i.	R.r.	S.m.	Mole sp.	M.m.	Total	Mite	Tick	Flea	Lice
1	Bara Bazar (Shillong)	20	6 (15.4)	-	3	-	3	-	6	+(2)	+(2)	+(4)	-
2	Pariong PHC (West Khasi Hills)	15	1 (2.6)	-	-	-	1	-	1	-	-	-	-
3	Markasa PHC (West Khasi Hills)	5	-	-	-	-	-	-	-	-	-	-	-
4	St. Paul's Seminary (Shillong)	56	16 (41.0)	-	1	1	16	-	18	+(2)	+(1)	+(12)	-
5	Panjabi Lane Market (Shillong)	20	5 (12.8)	1	2	3	-	-	6	+(4)	+(2)	+(2)	-
6	Myllien (West Khasi Hills)	19	1 (2.6)	-	-	-	-	1	1	-	-	-	-
7	Bara Bazar (Sweeper Colony), (Shillong)	22	10 (25.6)	-	3	8	-	-	11	+(6)	+(4)	+(10)	+(4)
Total		157	39(100)	1	9	12	20	1	43	+(14)	+(9)	+(28)	+(4)

B.i.-*Bandicota indica*, *R.r.*-*Rattus rattus*, *S.m.*-*Suncus murinus*, *M.m.*-*Mus musculus*
Ectoparasite collected: *Xenopsylla cheopis*, *Leptotrombidium deliense*, *Laelaps spp.*, *Schoengastiella ligula* and Lice.

A total of 43 rodents comprising of five species viz: *S. murinus* (12), *R. rattus* (9), *B. indica* (1) and *M. musculus* (1) and Mole species (20) were trapped. Ectoparasites (mite, flea, tick and lice) retrieved from the trapped rodents were preserved in 70% alcohol for identification and processing in the laboratory.

A total 68 larval trombiculid mite chigger (*L. deliense*) was vector of scrub typhus collected from the rodents giving an overall chigger index as 1.80, which was above the critical index of 0.69 per rodent. Chigger infestation rate was found to be 4.8. The chigger infestation was found mainly on *R. rattus*, *S. murinus* and

mole spp. Vector mite infestation was found to be highest (75%) amongst the rodents trapped followed by fleas, tick and lice. Sixty two *Xenopsylla cheopis* (vector of plague) were also retrieved from these rodents with flea index 1.44. A total of nine rodent serum samples processed for detection of *Orientia* (Scrub typhus) and plague antibodies and all the sample were found to be negative. Examination of thirty organs impression smear and organs (Lung, liver, spleen and heart) collected in KB medium were showed no plague bacilli activity and could not isolate *Y. pestis*. Earlier studies (Saxena 1989) revealed that chigger mites are habitat specific and found in abundance with forested terrain with

long grasses^[8]. Studies carried out in similar ecological condition in Himachal Pradesh during the outbreak of scrub typhus in 2003 wherein, higher chigger index (2.46) and flea index (0.89) was recorded and habitat conducive for harboring/propagation of rodents and mites^[9]. During the present study in Meghalaya the high chigger index was recorded as 1.80 which is much higher above the critical level of chigger load for a single case of scrub typhus i.e. 0.69 per rodent^[10]. The cases and deaths in different districts are regularly occurring in Meghalaya. Year and month wise occurrence of scrub typhus is given in Table 1.

Table 1: District wise occurrence of Scrub Typhus cases/deaths in Meghalaya during 2005-2011 year (As per report of IDSP)

Year	2005	2006	2008	2009	2010	2011
East Khasi Hills	5	-		15	10	1
West Khasi Hills	14	4	24	22	1	1
Jaintia Hills	-	-	-	6	-	-
Ri Bhoi	-	-	-	-	3	-
Patients with address not available	1	-	17	269	-	-
Total cases	20	4	43	312	14	2
No. of Deaths	5	1	6	7	-	-

In view of the regular occurrence of disease conducive ecology, presence of different rodent species and vector mite not only confirms the transmission of scrub typhus in the recent past in the Meghalaya but also warn the possibility of scrub typhus transmission in the future also.

4. Conclusion

As mentioned earlier that the Meghalaya is the wettest state of India and ecology highly support the survival of chigger mites. Cases of scrub typhus are reported in low social-economic group distributed far and wide in many districts of Meghalaya having characteristic terrain features supportive of scrub typhus. High infestation rate of rodents and vector *Leptotrombidium* mites support the probability of ongoing transmission of scrub typhus in the area. Before the onset of transmission season early case detection through regular surveillance and laboratory diagnosis should be strengthen for proper and early treatment of case to prevent morbidity and mortality due to scrub typhus. Intensive health education should be imparted in the health officials and local masses about causation of disease, vector mites; it's transmission cycle and seasonality, so that they can take preventive measures. For prevention and control of the scrub typhus people frequenting forest for the work may be advised to apply locally available repellent on legs, arms and other exposed body parts to prevent mite bites.

5. Acknowledgements

The authors are grateful to the Director, NCDC, for providing an opportunity to undertake rodent/flea survey in Meghalaya. Thanks are also due to Dr. R.R. Lanong, State Surveillance officer IDSP, Meghalaya, Mr. Paibha Trebor, Entomologist IDSP, Meghalaya, Dr .L .Kherkongor, M.O. (In charge), Pariong PHC, Dr .M. Parsi, M.O. (Ayush) Pariong PHC, Dr. S. D. Pariong, M.O. (In charge) PHC Markasa (West Khasi Hills) and Dr. A. L yngdoli, M.O. (Ayush) PHC Markasa (West Khasi Hills), Meghalaya.

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