

Entomological surveillance for rodent and their ectoparasites with special reference to potential of Scrub Typhus at Kolkata Port Trust (KPT), Kolkata (India)

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ABSTARCT

Rodents are well established at port areas and their ectoparasite can be vectors of many diseases. Ships at seaport play an important role in spreading disease by transporting infected vectors. Plague, murine typhus, salmonellosis, trichinosis, leptospirosis and rat bite fever are known to be spread by rats. In view of the seriousness of the problem present study was undertaken to assess the prevalence of rodent – ectoparasite association at Kolkata Port Trust, Kolkata (India). A total of 442 rodent traps were laid and 17 rodents including two species of rodents *Bandicota indica* and *Rattus rattus* were collected with 3.8 trap positivity rate. Infestation rate of ectoparasites was 76.5%. Mites with 86.6% were the predominant ectoparasite retrieved from rodents followed by fleas and lice. The rodent ectoparasite index was 13.6 per rat. A total 78 vector larval trombiculide mite chigger (*Leptotrombidium deliense*) and 123 mesostigmatid mites (*Laelaps* sp.) were collected. Chigger infestation rate was found to be 11.1 per rat. Passenger terminal was the only site where no mite could be retrieved. A total 26 fleas were retrieved giving an overall flea index as 1.53. The flea species collected from rodents were *Xenopsylla cheopis* and *Ctenocephalides felis*.

Serological examination of rodent serum was found non- reactive for *Orentia* (Scrub typhus) and plague antibodies. Bacteriological investigation of organs impression smear and tissue of rodents showed no plague bacilli activity and isolation of *Yersinia pestis*. Result of the study suggests routine surveillance for rodent and their arthropods ectoparasite to apply appropriate control methods for controlling transmission and spreading of rodent borne diseases.

Keywords: Scrub Typhus; *Bandicota indica*; *Rattus rattus*; *Leptotrombidium deliense*; *Xenopsylla cheopis*; Kolkata;India

INTRODUCTION

Rodents are an important vector for zoonosis and can act as reservoirs and involved in the transmission of more than 60 infectious diseases to humans. 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]. Human dispersal and colonization over the last few millennia has spread different species of rodents to many of the world's islands. These rodents are: ship or black rats (*R. rattus*), Norway or brown rats (*R. norvegicus*), Pacific rats (*R. exulans*) and house mice (*Mus musculus*). This spreading of rodent adversely affects native biodiversity and these exotic rodents carry

diseases that may affect native animals and human. Sea ports are the places where transportation and spreading rodents is possible. Now this spreading of rodents has become an international problem [4].

In order to ascertain the prevalence of rodent – ectoparasite association at Kolkata Port Trust, Kolkata a team from the National Centre for Disease Control (NCDC) visited Kolkata in April, 2013 with the following objectives:

- i. To determine the prevalence of rodents and their ectoparasite species in sea ports area.
- ii. To know the presence of *Orentia* (scrub typhus) and plague bacilli infection in rodents if any present.
- iii. To review the ectoparasite - rodents control strategy undertaken by the port health authorities.

MATERIALS AND METHODS

Study area

The Kolkata Port Trust is a riverine port in the city of Kolkata, India. It is the oldest operating port in India. This Port has two distinct dock systems - Kolkata Docks (KDS) at Kolkata and a deep water dock at Haldia Dock Complex (HDC), Haldia. Kolkata Dock System is situated on the left bank of the river Hooghly at 22° 32' 53" N, 88° 18' 5" E and Haldia Dock Complex is situated at 22°02' N, 88°06' E. Kolkata Dock System handled traffic of 12.233 million tonnes in 2011-2012 as against 12.540 million tonnes in 2010-2011. At Haldia Dock Complex, 31.015 million tonnes of traffic was handled in 2011-2012 as against 35.005 million tonnes in 2010-2011. Kolkata Dock System registered highest growth in container traffic amongst the major ports of India. To see the magnitude of problem related to rodents and their ectoparasite different Dock, Sheds and Terminals at seaport area were selected for trapping rodents.

Trapping locations

Different spots at Kolkata port were surveyed and trapping of rodents was conducted in seven different sites with the intention to trap maximum number of rodents. Following docks, sheds and terminal were selected to trap rodents:

1. KP-Dock-1
2. KP-Dock-2
3. KP-Dock-10
4. KP-Dock-7
5. KPT Shed -10
6. KPT Shed- 12
7. Passenger Terminal

One passenger ship was also inspected to detect rodent activity.

Trapping and processing of rodent species

Rodents were collected using live traps (wire cage and wonder traps). The traps were baited with fried eatables smeared with butter and laid in the evening at pre-selected docks, sheds and passenger terminals. The traps were collected on the next morning and brought back to the laboratory. Rodents collected were anaesthetized and identified after recording their different morphological characteristics. To detect *Orentia* and plague bacilli infection rodent blood was drawn, serum was separated and tested for Weil Felix reaction and plague antibody test [5-6].

Dissection of rodents was done and organs impression smear of rodent heart, lung, liver and spleen were made and fixed for identification of plague bacilli. These organs were also placed in culture (KB) medium for isolation of *Y. pestis*. Serological and bacteriological investigations were carried out at Zoonosis Division.

Examination and processing of ecto-parasites

The ectoparasites were recovered by combing the rodents against the fur of rodents over a white tin pan. The snout, ears, limbs and axillary region of individual rodents were combed and ectoparasite were collected and preserved in 70% alcohol for further processing. The contents of the enamel tray were examined carefully with a hand lens and any ectoparasites seen were recovered. All preserved ectoparasites were later mounted using clearing, dehydration and mounting procedure for identification using the standard method described earlier by Kumar in 1997 [7].

RESULTS

During the investigation a total of 442 rodent traps were laid in the different Sheds, Docks and Passenger terminal. The overall traps positivity rate was recorded as 3.8 per cent. From positive traps a total of 17 rodents in order of their prevalence were *B. indica* (70.6%) and *R. rattus* (29.4%) with 64.7% male and 35.3% female. The overall infestation rate of ectoparasites was recorded 76.5 per cent (Table 1). Area wise number of traps laid, rodent collected and ectoparasites retrieved are shown in table-2. Ectoparasites (mite, flea and lice) retrieved from the trapped rodents were preserved in 70% alcohol for identification and further processing.

As a result of combing of the rodents mites (86.6%) were the predominant ectoparasite retrieved from all the seven sites followed by fleas and lice. Over all rodent ectoparasite index was 13.6 per rat. A total 78 vector larval trombiculide mite chigger (*L. deliense*) and 123 mesostigmatid mites (*Laelaps* sp.) were collected from the rodents (Table 3). Chigger infestation rate was found to be 11.1 per rat. The chigger infestation was found on both the rodent species collected. Passenger Terminal was the only site where no mite could be retrieved. During the combing of these rodents 26 fleas were retrieved giving an overall flea index as 1.53. The

maximum fleas were collected from KP-Dock-10, KPT Shed-10 and Passenger Terminal. The flea index recorded in the present studies is above the critical index of one, which requires anti fleas measure in the area. The flea species collected from rodents were *X. cheopis* and *C. felis*.

A total of seventeen serum samples taken from various rodents species captured alive were

processed for detection of *Orentia* (Scrub typhus) and plague antibodies and all the samples were found non-reactive. Examination of organs impression smear of rodent heart, lung, liver and spleen showed no plague bacilli activity. Similarly, inoculation from the tissue of rodents could not show isolation of *Y. pestis*.

Table 1. Prevalence of rodent and their ectoparasites in Kolkata Port Trust, Kolkata, West Bangal (India).

Locality	No. of traps used	Traps found +ve	Rodent species (Per cent)			Ectoparasites Collected (No. of Infested Rodent)			
			B.i.	R.r.	Total	Mite	Flea	Lice	Total
KP-Dock-1	100	1	-	1-F	1	121 (R.r.-1F)	-	-	121 (1)
KP-Dock-2	20	1	1-M	-	1	3(B.i.-1M)	-	-	3 (1)
KP-Dock-10	100	5	2-M,2-F	1-M	5	9(B.i.-1M) 6(B.i.-1F) 5(R.r.-1M)	2(R.r.-1M) 3(B.i.-1M) 3(B.i.-1F)	1(B.i.-1F) 2(R.r.-1M) 2(B.i.-1F)	33 (5)
KP-Dock-7	75	3	1-M, 1-F	1-F	3	8(B.i.1F)	-	-	8 (1)
KPT Shed-10	80	3	3-M	-	3	2(B.i.-1M)	10(B.i.-2M)	-	12 (3)
KPT Shed- 12	37	2	1-M	1-M	2	47(B.i.-1M)	3(B.i.-1M)	-	50 (1)
Passenger Terminal	30	2	1-M	1-F	2	-	5(B.i.-1M)	-	5 (1)
Total	442	17	12 (70.6)	5 (29.4)	17 (100)	201 (8)	26 (7)	5 (3)	232 (13)

B.i.-*Bandicota indica*, R.r.- *Rattus rattus*, M-Male, F-Female

Table 2. Ectoparasites recovered from rodents host species from Kolkata Port Trust, Kolkata, West Bangal (India).

collection site	Rodent Host Species (Sex)	Ectoparasite recovered		
		Mites	Chiggers	Fleas
KP-Dock-1	R.r.(F)	<i>Laelaps</i> spp.	-	-
KP-Dock-2	B.i.(M)	-	<i>Leptotrombidium deliense</i>	-
KP-Dock-10	B.i.(M)	<i>Laelaps</i> spp.	<i>Leptotrombidium deliense</i>	-
	B.i.(F)	-	<i>Leptotrombidium deliense</i>	-
	R.r.(M)	-	<i>Leptotrombidium deliense</i>	<i>Xenopsylla cheopis</i>
	B.i.(M)	-	-	<i>Xenopsylla cheopis</i>
	B.i.(F)	-	-	<i>Xenopsylla cheopis</i>
KP-Dock-7	B.i.(F)	-	<i>Leptotrombidium deliense</i>	-
KPT Shed -10	B.i.(M)	<i>Laelaps</i> spp.	<i>Leptotrombidium deliense</i>	-
	B.i.(M)	-	-	<i>Xenopsylla cheopis</i> , <i>Ctenocephalides felis</i>
	B.i.(M)	-	-	<i>Xenopsylla cheopis</i>
KPT Shed- 12	B.i.(M)	-	<i>Leptotrombidium deliense</i>	<i>Xenopsylla cheopis</i>
Passenger Terminal	B.i.(M)	-	-	<i>Xenopsylla cheopis</i>

B.i.-*Bandicota indica*, R.r.- *Rattus rattus*, M-Male, F-Female

Table 3. Mite infestation and rodent species captured from Kolkata Port Trust, Kolkata, West Bangal (India).

Rodent species	Total rodents trapped No. (%)	Rodents positive for trombiculid mite No. (%)	Rodents positive for other mite No. (%)	Trombiculid mite No. (%)	Other mite No. (%)	Chigger index
<i>Rattus rattus</i> ,	1(12.5)	0(0)	1(33.3)	0(0)	121(98.4)	0.0
<i>Bandicota indica</i>	7(87.5)	7(100)	2(66.7)	78(100)	2(1.6)	11.14
Total	8(100)	7(100)	3(100)	78(100)	123(100)	

DISCUSSION

There is no documented survey of ectoparasites on rodents in Kolkata Port Trust area. So, present study was done in port area to obtain data on the distribution of rodents and their ectoparasites for future planning of prevention and control measures for zoonotic diseases in the area. During the present study it was observed that the different shed are used for storage of food grains and other items which are in transit from cargo ships to respective jetties thereby increasing the potential for propagation and multiplication of rodent and ectoparasites. Though the density of rats was very low but the rodents were collected from all the collection sites. Maximum numbers of rodents were collected from KP-Dock-10. Thirteen (76.5%) rodents were found to be infested with at least one species of ectoparasite with 69.2% male and 30.7% female. No association between sex of rodents to the infestation rate was noticed. Earlier similar observation was revealed by Paramasvaran *et al.*, (2009) in Kuala Lumpur, Selangor, Negeri and Sembilan States of Malaysia [8].

Trombiculide mite chigger (*L. deliensis*) recovered from both the rodent species collected is an established scrub typhus vector. These are habitat specific and found in abundance with forested terrain with long grasses [9]. In the present study the chigger index found to be 11.14 in *B. indica*, which was above the critical level of chigger load i.e. 0.69 per rodent [10]. *R. rattus* were found free of chigger mites. While during an outbreak investigation in Himachal Pradesh, Kumar *et al.* (2004) calculated the chigger index as 2.46 [11]. More than 120 mesostigmatid mites *Laelaps* sp. were also recovered from *R. rattus* collected from Dock-No.-1. The flea index is used

to estimate human and epizootic risk for plague [12], a flea index >1 represents an increase plague risk in human [13]. The flea index found in the present study was 1.53, more than the threshold for plague transmission. So, routine surveillance of flea indices on rodent should be conducted. Earlier at different seaport of Indonesia the flea-index was calculated as 8.4 in *R. norvegicus*, 4.9 in *R.r. diardii* and 0.7 each of *R. exulans* and *S. murinu* (Semarang seaport), 9.4 in *R. norvegicus* (Soekarno seaport) and 10.3 in *R. norvegicus* (Hatta seaport) [14].

No rodent activity could be detected during the inspection of one passenger ship. However, the rat gaurds were not placed properly on some of the ropes showing negligence from ship staff and in checking from BPT staff. Rodent control is being done by private staff while no antiflea measure is being undertaken during rodent killing. Staff working at port is not trained to collect and control rodent/flea.

CONCLUSION

The present study concluded that regular and continuous rodent and ectoparasite surveillance should be carried out to maintain rodent, flea and mite density below critical level.

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