ENTOMOLOGICAL SURVEILLANCE FOR VECTOR OF PLAGUE AND SCRUB TYPHUS AT CHENNAI PORT TRUST (CPT), CHENNAI, INDIA

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[Sharma, A. K. & Kumar, K. 2016. Entomological surveillance for vector of plague and scrub typhus at Chennai Port Trust (Cpt), Chennai, India. Munis Entomology & Zoology, 11 (1): 68-72**]**

ABSTRACT: Rodents are responsible for the transmission of many human diseases. The diseases can be viral, bacterial or rickettsial e.g. lyssavirus, scrub typhus, plague and hantavirus. These disease can be transmitted to humans in a number of ways including animal bite, contact with animal waste, eating food or water contaminated by rodent waste or through parasites that use rodents and humans as hosts e.g. fleas, mites and ticks. Presence of rodents in and around port areas plays an important role in the transportation of rodents and their ectoparasite from one country to another. In view of the seriousness of the problem present study was undertaken at Chennai port area (CPT), Chennai (India). Inside port area total 170 rodent traps were laid and 14 rodents were trapped. *Rattus rattus, R. norvegicus* and *Suncus murinus* were the species collected from port area. Two species of flea viz. *Xenopsylla cheopis* and *X. astia* were recovered from rodents and overall flea index was recorded as 3.3. Larval trombiculid chigger mite (*Leptotrombidium deliense*) and mesostigmatid mites (*Laelaps* sp.) were collected and 1.1 chigger index was recorded. Present study confirm presence of rodents, vector of plague and scrub typhus in and around CISF Barrack, Canteen CISF Barrack, M.O.H.P. Office, Dumper House, CISF 'A' Coy Barrack and CISF 'A' Coy Mess. Result of the study suggests an urgent need to establish an entomology unit at CPT for doing regular surveillance of vector-borne zoonotic and other diseases.

KEY WORDS: Rodent, Plague, Scrub typhus, *Xenopsylla cheopis, Leptotrombidium deliense,* Chennai port trust.

In the past century alone, more than 10 million people have died from rodent-borne diseases. Rodents by their nature and design, make excellent "vehicles" for harboring and rapidly transporting diseases to human being mainly Plague and Scrub typhus along with several other diseases. Rodents can act as reservoirs of a number of human diseases and as hosts for arthropod vectors such as fleas, mites and ticks. In addition, rodent can also transmit Leptospirosis, Salmonellosis, rat-bite fever, Chagas' disease, Omsk hemorrhagic fever, Murine typhus, and Lassa fever etc., which are non vector borne (Bell et al., 1988).

In India, flea species *X. cheopis* (Rothschild, 1903) and *X. astia* (Rothschild, 1911) are the principal vectors for plague which is caused by the bacterium *Yersinia pestis.* In India, there was several plague episodes reporting millions of deaths before 1940s; thereafter, morbidity and mortality due to plague among human reduced greatly. During the resurgence of plague in 1994 a total of 454 cases and 54 deaths were reported from district Beed in Maharashtra and Surat in Gujarat state (India). Thereafter, plague cases has been reported from Himachal Pradesh in 2002 and Uttarkashi in 2004. Although, no human case of plague have been reported so far from any part of Mumbai but the entire Maharashtra state has the potential for plague and falls in the endemic zone (Agarwal, 2002; Agarwal et al., 2005). The presence of rickettsial disease including scrub typhus has been documented in different parts of Maharashtra and other states (Jammu & Kashmir, Himachal Pradesh, Uttranchal, Rajasthan, Assam, West Bengal, Kerala, and Tamil Nadu) of India (Padbidri & Gupta, 1978; Mahajan et al., 2006).

In the resent past scrub typhus cases have been reported from Chennai also. In view of the emergence of ectoparasite borne diseases in different parts of country and role of ports in introduction of diseases, vectors and rodents from one country to another, we undertook the present study in April 2014 in Chennai Port Trust, Chennai and determined the prevalence of rodent species, its association with ectoparasites and potential for ectoparasite borne diseases.

MATERIALS AND METHODS

Study area: Chennai Port, formerly known as Madras Port, is the largest port in the Bay of Bengal. Port area is divided into north, central and south zones and fishing harbours. The port has 26 alongside berths, including 21 deep-drafted berths and 2 oil jetties, in the 3 docks, viz., Dr. Ambedkar Dock, Satabt Jawahar Dock, and Bharathi Dock along with the container terminal, and draft ranging from 12–16.5 m (39–54 ft). Dr. Ambedkar Dock has 12 berths, Jawahar Dock has 6 berths, Bharathi Dock has 3 berths (for oil and iron ore), the container terminal has 3 berths and the moorings has 1 berth.

The port is situated on the thermal equator and is also coastal, which prevents extreme variation in seasonal temperature. The climate is tropical, specifically tropical wet and dry, and for most of the year, the weather is hot and humid, with temperatures ranging from a maximum of 42 °C in May to a minimum of 18 °C in January. The mean minimum temperature is 18 °C in January and 26.8 °C in May. The mean highest temperature is 29.3 °C in December and 39.6 °C in May. The port gets most of its seasonal rainfall from the northeast monsoon winds, from mid-September to mid-December. Occasionally, cyclones in the Bay of Bengal hit the coast. The average annual rainfall in the region is about 1298.11 mm, with 443.5 mm during southwest monsoon (June–September), 753.1 mm during northeast monsoon (October–December), 37.3 mm during winter season (January–February) and 64.2 mm during hot weather (March–May). The tides in the port area are semi-diurnal in nature, that is, occurrence of two high and two low waters every day.

Rodents trapping locations*:* Chennai port has an area of 274 hectares and divided into north, central and south zones and fishing harbours. During present study nine sites were selected for trapping rodents in Chennai Port Trust (CPT) areas: (i) CISF Barrack, (ii) Canteen CISF Barrack, (iii) M.O.H.P. Office, (iv) D P Building, (v) Mechanical engineer Office, (vi) Dumper House, (vii) Electrical Shop, (viii) CISF 'A' Coy Barrack (ix) CISF 'A' Coy Mess.

Rodent and ectoparasites collection & identification: Rodents were collected using live traps. The traps were set at pre-selected sites. The traps were baited with fried eatables smeared with butter and laid in the evening. Next morning caught rodents were kept individually, and brought back to the laboratory, where all rodents were anaesthetized, and identified after recording their different morphological characteristics. The rodents were placed in a white enamel tray and combed vigorously from the tail forward with a fine comb. Dislodged ectoparasites that fell from the host to the bottom of the enamel tray were collected with a fine pointed forceps, brush or stick. Ectoparasites on the body of animal were also extracted. Ear and nasal canals were examined for chiggers. All extracted ectoparasites were preserved in 70% alcohol labelled collection tubes for further processing. A separate tube was used for each rodent host. All ectoparasites were later mounted using clearing, dehydration and mounting procedure for identification using the standard method described earlier by Kumar et al. (1997a). Fleas and mites were mounted in

Hoyer's medium. Mounted slides were then incubated at 40°C for a week and identified under microscope.

RESULTS AND DISCUSSION

A total 170 rodent trap were laid and 14 traps were found positive for rodent, giving an overall trap positivity rate of 8.2 per cent. From positive traps, total 14 animals comprising three species of rodents were caught from port area. *R. rattus* was the dominant rodent caught (50%) followed, *R. norvegicus* (35.7%) and *S. murinus* (14.3%) with 71.4% male and 28.6% female. During the combing of these rodents, total 46 fleas were recovered, giving an overall flea index as 3.3. The maximum number of flea (12) retrieved from *R. rattus* trapped from CISF 'A' Coy Mess. The flea species collected from rodents were identified as *X. cheopis* and *X. astia* (Table 1).

A total 15 vector larval trombiculid chigger mite (*L. deliense*) and 47 mesostigmatid mites (*Laelaps* sp.) were collected with 1.1 chigger index. Only one *S. murinus* was found infested with chigger mites collected from Dumper House in the port area. *Laelaps* mites were recovered from the rodents collected from CISF 'A' Coy Mess and Barrack (Table 1).

There is not much data on rodent and ectoparasite surveillance from Chennai or other port of India. Earlier in 2014 in a similar rodent ectoparasite surveillance at Kolkata Port Trust, Kolkata (India) two species (*Bandicota indica* and *R. rattus*) were collected with trap positivity rate 3.8 percent and flea index 1.53 (Sharma & Kumar, 2014). The threat of transportation and introduction of diseases, vectors and rodents from one country to another from port is a international problem (Goh & Kumarapathy, 1985; Jenkin et al., 1995; Song et al., 2006).

In similar kind of study 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) (Megawe et al., 1987). In the present survey flea index was 3.3, more than critical index (*i.e.* index 1.0) for plague transmission (Dennis et al., 1999). This finding re-emphasizes the need of anti-fleas measure in the port area. Earlier in other part of India, in a study in Maharashtra, trap-positivity rate was found to be 49.0% and overall flea index of 2.34 with highest 16.5 in village Chinchoti and 8.5 in village Purshotampuri of Maharashtra (Kumar et al., 1997a). However, in Beed district of Maharashtra and Gujarat, *X. cheopis* was found as a main vector of plague with flea index ranging from 0.26-1.0 in different district and examination of blood serum, tissue organ revealed no evidence of plague pathogens (Kumar et al., 1997b). In other part of India flea index was found 0.89 in Himachal Pradesh, which was below the critical index of 1.0 (Kumar et al., 2004) and in Shimoga district of Karnataka flea index was 1.64, which was just above the critical limit (Kumar et al., 2008). In scrub typhus affected areas of Meghalaya, (India) 43 rodents, and 28 fleas were collected with trap positivity rate 24.8 per cent, and flea index 1.44 (Sharma, 2013a). In Thiruvananthapuram, Kerala (India) flea index was recorded as 0.13 (Sharma, 2013b).

In the present study, the chigger infestation was found only on *S. murinus* and *B. indica*. Earlier in Kolkata Port, India, a total 78 *L. deliense* were collected with high chigger index (11.14) in *B. indica* (Sharma & Kumar, 2014). While in an outbreak investigation in Himachal Pradesh (India) (Kumar et al., 2004) collected same vector larval trombiculid mite chigger (*L. deliense*) with 2.46 chigger index. In Meghalaya and Thiruvananthapuram, Kerala (India) chigger index was calculated as 1.80 and 1.74 respectively (Sharma, 2013a,b). These earlier studies confirm the wide spread of rodents and their ectoparasites in different parts of

India and inside port areas their presence is a serious problem. In our study rodent activity was detected, rodents were trapped and ectoparasites were retrieved in and around CISF Barrack, Canteen CISF Barrack, M.O.H.P. Office, Dumper House, CISF 'A' Coy Barrack and CISF 'A' Coy Mess. Presence of rodent rat flea and chigger mites in and around CISF Barracks and Canteen is a matter of concern depicting potential for Scrub typhus. The present investigation emphasized the importance of regular and continuous rodent and flea surveillance to monitor the flea/chigger index. If any area reports flea index/chigger index above critical limit, then vector control measures should be carried out to maintain vector density below critical level and to prevent diseases transmission, if any.

As per International Health Regulation Act (2005) there is an urgent need to establish an entomology unit at Chennai Port Trust (CPT) for doing effective regular surveillance for rodent and their arthropods ectoparasite to apply appropriate control methods for controlling transmission and spreading of rodent borne diseases.

ACKNOWLEDGEMENTS

Authors would like to thank Port Health Officer and their technical staff for their active cooperation and help during the survey. Thanks are also due to Mr. TC Pathak and Mr. BD Gupta of NCDC, Delhi, for the technical assistance during the fieldwork. The authors declare that they have no conflict of interest.

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Table 1. Details of the rodent and their ectoparasite collected from Chennai Port Trust, Tamil Nadu (India) during April, 2014.

	Site	Trap Laid	Rodent Trapped	Rodent Species	Sex	LD	LS	XC	XA	LI
1	CISF Barrack	40	1	RN	M	-	-			
2	Canteen CISF Barrack	30	1	RN	F	-	-	8		3
3	M.O.H.P. Office	20	1	RN	M	-	-			
			2	RN	M	-	-	6		
4	D P Building	10	-	-	-	-	-	-	-	-
5	Mechanical Engineer Office	10	-	-	-	-	-	-	-	-
6	Dumper House	10	1	SM	F	15	-			
7	Electrical Shop	10	-	-	-	-	-	-	-	-
8	CISF 'A' Coy Barrack	20	1	RR	F	-	-		5	
			2	RR	M	-	-		4	
			3	SM	M	-	15			
			4	RR	M	-	21			
9	CISF 'A' Coy Mess	20	1	RR	M	-	-	1		
			2	RR	M	-	-	3		
			3	RR	M	-	-	1		
			4	RN	M	-	8	6		
			5	RR	F	-	3	12		
Total		**170**	**14**	**RN-4(M)1(F), SM-1(M)1(F), RR-5(M)2(F)**		**15**	**47**	**37**	**9**	**3**

SM-*Suncus murinus*, RR- *Rattus rattus*, RN- *Rattus norvegicus*, XC- *Xenopsylla cheopis*, XA- *Xenopsylla astis*, LD- *Leptotrombidium deliense*, LS- *Laelaps* Spp., LI-Lice, M-Male, F-Female