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Abundance and distribution of chigger mites (Acari: Trombiculidae) in India: A review

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Abstract
Chigger mites (Acari: Trombiculidae) are specific biological vector of Zoonotic disease scrub typhus and characterized as medically-relevant arthropod vector. The larval stage of chigger mite has a unique mode of parasitism and carries disease causative agent gram-negative bacterium *Orientia tsutsugamushi*. The objective of the study is to summarize the abundance and distribution of different vector mite species in India. For this purpose various research articles have been reviewed and it was found that chigger mites are disseminated globally as ectoparasites of a wide range of vertebrate hosts like rodents, cattle, aves, and sometimes on invertebrates. Chigger mites are abundant in world-famous tsutsugamushi-triangle bounded areas. In India, they are well distributed and cover almost the whole geographical area.

Keywords: chigger mite, scrub typhus, *Orientia tsutsugamushi*, zoonotic disease, vector

Introduction
Chigger mites belong to the family Trombiculidae which are important to public health department due to ability to carry disease causative bacterium *Orientia tsutsugamushi*. According to the available data, out of the world, approximately 220 families have been reported consisting of about 40,000 acarine species and out of them approximate 3000 mite species have been identified. The Trombiculidae family members are also named as Red bugs, Itch mite, Scrub mite, *Tsutsugamushi*, etc [1]. Chiggers are vectors of scrub typhus disease that belong to order Acarina which was initiated within a solitary genus and subgenus of trombiculid mites: *Leptotrombidium*.

The vector chigger mites were bounded to one specific geographical region named as *tsutsugamushi* triangle that coversapprox 13 million km^2 area. The tsutsugamushi region covers Japan in the East, through China, Phillippines, tropical Australia in the South, and West through India, Pakistan, possibly to Tibet to Afghanistan, and South parts of the USSR in the North [2]. But in recent studies, it is confirmed that the vector species are being reported beyond the triangle bound region. Chigger mites are found in both tropical and subtropical regions and are considered as widespread ectoparasite in the world.

Step by step, Chigger mites naturally occupy demarcated area in the soilwhere the ecosystem is found favourable for mitesthat is known as “Mite Island”. These mites feed the serum of warm-blooded animals only once during its life cycle of development whereas adult mites do not feed. The causative agents (*Orientiatsutsugamushi*) of scrub typhus disease are transmitted by the trans-ovarian method in the progeny of mites. The scrub typhus disease normally occurs in a range of mammals, particularly in the field mice and rodents [3]. Their vector species have been reported from all twenty-nine states of India sparing only four Union Territories. In this regard, NIV Pune had conducted a series of chigger surveys over the past 3 decades in different eco-geographical regions of India, including the Western Himalayas, Sikkim, and the Hill Districts of West Bengal, Rajasthan, Maharashtra, Goa, Orissa, Gujarat, and Karnataka.

Material and Method
A systematic literature review of vector mite species related to its abundance and distribution was carried out by collecting scientific articles which were analysed cautiously, further important information was collected with the help of electronic databases such as Google Scholar, PubMed, Springer, Research Gate, and other Prestigious Journals and Research Papers. In order to determine disease outbreaks in various regions, websites of National Centre for Disease Control (NCDC) and Indian Disease Surveillance Programme (IDSP) were also visited. On the basis of collected information, our research will depict the chigger mite species complex, their abundance and distribution in India.

Abundance and Distribution of Chigger mite species
More than 50 species have been reported that are attacking humans, out of them 20 species are considered to be medically important because they cause skin infection or due to their role as vectors of human pathogens[4]. In Asia, *Leptotrombidium* species is considered as the principal vector of scrub typhus [5]. Amongst these *Leptotrombidium* (*L.*) species, only 10 species have been reported as vectors [6], and more than approx 150 mite species of this subgenus have been identified from Asia. Some other genera such as *Ascoschoengastia*, *Blankaartia*, *Gahrliepia*, *Eutrombicula*, *Microtrombicula* and *Odontocarus*etc which were found to carry the pathogen but suspected to transmit the disease [7]. Globally, more than 45 species of trombiculid mites are known to be infected with *O. tsutsugamushi* but only *L. deliense*, *L. pallidum*, *L. Pavlovsky*, *L. scutellare*, *L. imphalum*, *L. chiangraiensis*, *L. fletcheri*, *L. gaohuensis*, *L.*

arenicola, and *L. Akamushi* were proven to transmit scrub typhus disease [8]. The *Leptotrombidium deliense* group of vector mites are widely distributed all over the country, co-existing primarily with rodents and other small mammals.

Generally, Mites prefer to attach with the host in belly region, ear pinna, and inner thigh and seems like orange or pink colour [3]. According to the literature it has been observed that there is no host-specificity of chigger mite because many species of trombiculid mites were found on every kind of host [9].

In India, the first scrub typhus vector species was reported in 2009 from Kerala [10] apart from this, the presence of chigger mites have been also reported from North, East and South India [11]. The distribution of Chigger mites was also recorded from entire region of the Shivalik ranges from Kashmir to Assam, Eastern, the Western Ghats, the Vindhyachal and Satpura range in the central part of India [12]. Cases of Scrub typhus disease have been reported mostly among soldiers during Second World War in Assam, West Bengal and also in Indo-Pak war in 1965 because previously the inhabitation of chigger mites were only in scrub jungles [13]. Thereafter, a resurgence of the disease also occurred in a unit of army in 1990 which was deployed at the Pakistan border of India due to an expansion of distribution areas of mite.

In 2013, a study was carried out in Puducherry and adjoining areas of Tamil Nadu in context to distribution and an abundance of chigger mites and a detailed description about chigger index and its reservoir was also given [14].

According to the National Centre for Disease Control Newsletter (2012), distribution of chigger mite in India was more in 2011 in comparison of 2012 that shows the irregular prevalence of disease. Till 2014, all 29 states and 4 Union territories of India reported abundance of chigger mites and it was also reported that during this period of time the chiggers were not restricted to the military areas but it affected the civil population also [15, 16, 17]. From India, chigger mite has been also reported from Rajasthan, Jammu & Kashmir, Vellore, Assam, Sikkim, Darjeeling, Nagaland, Manipur, Himalayas, Himachal Pradesh, and Madhya-Pradesh, etc [3, 18]. Walch (1922) reported various aspects of the biology of trombiculid mites in the field as well as in the laboratory with special reference to *L. delience* during the period between January 1970 to September 1971, in four selected localities in the Western Ghats of Poona District, India. The major aspects of biology taken up for this research in the field were to observe prevalence of species of trombiculid mites, the prevalence and abundance of small mammals which act as host for chigger mites, and the abundance of elites in relation to hosts, seasons, and environment[19]. Another species of mite *L. akamushi* also had been reported by Varma (1969, 1972) from Sikkim [20].

Another genus of mites is also playing a role as a vector to transmit the scrub typhus disease such as *Schoengastiella lingula* of the tribe *Gahrliepiini* that has also been implicated as an important disease vector in India [21]. In the Himachal Pradesh outbreak, it was observed that causative agent of scrub typhus disease is *Orientia tsutsugamushi* and vector species are *L. delience* and *Gahrliepia* (*Schoengastilla*), further during the investigation, chigger index has been recorded which was about 23.0 in one village of study area. Some other ectoparasites such as other mite species, ixodid ticks, fleas, and lice have also been observed [22].

During the investigation of scrub typhus outbreak in Kurseong, Darjeeling, a total number of 52.96% vector abundance with a chigger index of 61.56 was observed but an unexpected result was seen that the vector chigger mite *Schoengastiella ligula* was the dominant vector species rather than *L. deliense* in the study area. This study was carried out by Armed Forces Medical College, Pune and found the presence and abundance of vector trombiculid mite species in all subdivisional areas of Darjeeling [23].

In Meghalaya, the entomological survey was carried out and concluded that *L. delicense* is playing a role as principle and Predominant species (Sharma, 2013), An eco-entomological investigation was conducted in Thiruvananthapuram, Kerala where distribution of chigger mites was observed across the state where it has been also noticed that *L. deliense* is the dominant vector species with a 1.74 chigger index [24]. Likewise an another survey was carried out in Kolkata and researches also observed the same results that *L. deliense* is a predominant species amongst all the ectoparasites [25]. Further another study was also reported that *L. delicense* is the predominant species amongst other nine collected mite species and distributed in high number with high chigger index in the Puducherry& Tamil Nadu regions, reason behind the high chigger index was active transmission between vector mite and host vertebrates [26]. Further another study depicted about vector diversity, abundance, and their distribution by the Zoonotic Surveillance which was commenced in six selected study areas in India, Akhnoor, Jammu, Udhampur Nagrota, Rajouri Poonch, Pune and Dehradun [27]. Another study also described the distribution and abundance in Gorakhpur and Uttar-Pradesh with high number of chigger mites belonging to twelve species and also reported that *L. deliense* is the predominant species [28].

Conclusion

The chigger mites *(Leptotrobmbidium)* are considered as important vectors in Global Public Health. From different studies, it has been concluded that the chigger mites are not area bounded vectors but also reside in the new areas beyond its traditional tsutsugamushi triangle and were also reported across all over India with a high chigger index. A total number of 204 chigger mite species have been reported from various geographical regions of India which are mostly abundant in tribal belt of India that includes nine States such as Rajasthan, Gujrat, Andhra-Pradesh, Odisha, Madhya Pradesh, Chhattisgarh, West Bengal and Jharkhand. The highest chigger index was reported from Puducherry and Tamil Nadu. In India the vector mites are also reported from Jammu & Kashmir, Vellore, Sikkim, Nagaland, Darjeeling and Manipur.

On the basis of reported outbreaks, it has been observed that *Leptotrombidium deliense species of* vector mite is predominant species in India and playing an important role for disease transmission.

Reference

1. Wharton GW, Fuller HS. A Manual of Chiggers. The Biology, Classification, Distribution, and Importance to Man of the Larvae of the Family Trombiculidae (Acarina). Mem. Ent. Soc. Wash, 1952.
2. Jensenius MFP. Rickettsioses and the international traveler. Clin. infect dis, 2004; 1493-1499.
3. NCDC Newsletter, Monthly Newsletter from the

National Centre for Disease Control (NCDC) NCDC Newsletter, 2009, 13(1).
4. Santibáñez P, Palomar AM, Portillo A, Santibáñez S, Oteo JA. The Role of Chiggers as Human Pathogens. An Overview of Tropical Diseases Intech, Open access Book, Chapters Published Online ISBN 978-953-51-2224-1, 2015.
5. Mullen G, O'Connor B. Mites (Acari). In: Durden L, Mullen G (Ed.). Medical and Veterinary Entomology. Academic Press, 2002, 449-516.
6. Traub R, Wisseman CL, Jr Jones MR, O'Keefe JJ. The Acquisition of Rickettsia Tsutsugamushi By Chiggers (Trombiculid Mites) During the Feeding Process. Ann N Y Acad Sci. 1975; 266:91-114.
7. Vercammen-Grandjean PH, Langston RL. The Chigger Mites of the World (Acarina: Trombiculidae & Leeuwenhoekiidae). 1st Edition, San Francisco; George Williams Hooper Foundation, University; Of California, 1975.
8. Martínez FA, GÁ L. Syndromic classification of rickettsioses: an approach for clinical practice. Int J Infect Dis. 2014; 28:133-139.
9. Traub R, Wisseman CL Jr, Ahmad N. The occurrence of scrub typhus infection in unusual habitats in West Pakistan. Trans R Soc Trop Med Hyg. 1967; 61:23-57.
10. Ittyachen AM. Emerging infections in Kerala: A case of scrub typhus. Natl Med J India. 2009; 22:333-4.
11. Isaac R, Verghese GM. Scrub typhus: Prevalence and diagnostic issues in rural South India. Clin Infect Dis. 2004; 39:1395-6.
12. Chakraborty S, Sarma N. Scrub typhus: An emerging threat. Indian J Dermatol. 2017; 62:478-485.
13. Singh P. Scrub typhus a case report: Military and regional significance. Med J armed forces India. 2004; 60:89-90.
14. Viswanathan S, Muthu V, Iqbal N, Remalayam B, George T. Scrub typhus meningitis in South India– a retrospective study. PLoS One. 2013; 8:e66595.
15. Vivekanandan M, Anna Mani, Yamini Sundara Priya, Pratap Singh Ajai, Samuel Jayakumar, Shashikala Purty, *et al*. Outbreak of scrub typhus in Pondicherry. J Assoc Phys India. 2010; 58:24e28.
16. Dass R, Mani ND, Gohain S. Characteristics of pediatric scrub typhus during an outbreak in the North Eastern region of India: peculiarities in clinical presentation, laboratory findings and complications. Indian J Pediatr. 2011; 78(11):1365e1370.
17. Sinha P, Gupta S, Dawra R, Rijhawan P. Recent outbreak of scrub typhus in North Western part of India. Indian J Med Microbiol. 2014; 32:247e250.
18. Chauhan M, Mahajan S, Manish S, Abrol RK. Scrub typhus: An emerging scourge. Indian J Basic and Applied Med Res. 2015; 4(4):394-401.
19. Walch E. Over Trombiculadeliensis n. sp. Ver moedelijkeoverbrengster der pseudo typhus, enandere Trombiculae van Deli (eerstemededeeling) — Geneesk. Tijd. Ned-Ind. 1922; 62:530-588.
20. Verma RN. Prevalence of *Leptotrombidium deliense*, the Scrub Typhus Vector, in the Eastern Himalayas, Nature International Journal of science. 1969; 222:984-985.
21. Oaks JSC, Ridgway RL, Shirai A, Twartz JC. Scrub typhus. United States Army Medical Research Unit, Institute for Medical Research, Malaysia. Bulletin No. 1983; 21:1-107.
22. Kumar K, Saxena VK, Thomas TG, Lal S. Outbreak investigation of scrub typhus in Himachal Pradesh (India). J Commun Dis. 2004; 36:27.
23. Tilak R, Kunwar R, Wankhade UB, Tilak VW. Emergence of *Schoengastiella ligula* as the vector of scrub typhus outbreak in Darjeeling: has *Leptotrombidium deliense* been replaced? Indian J Public Health. 2011; 55(2):92-9,
24. Sharma AK. Eco-entomological investigation in scrub typhus affected area of Thiruvananthapuram, Kerala (India) and their control/containment measures. Int J Curr Micro biol Appl Sci. 2013; 2:43-9.
25. Sharma AK, Kumar K. Entomological surveillance for small mammal and their ectoparasites with special reference to potential of scrub typhus at Kolkata Port Trust (KPT), Kolkata (India). J Paramed Sci. 2014; 5:1-6.
26. Sadanandane C, Ayyanar P, Karthikeya S. Purusho tha man Abundance distribution of trombiculid mites & Orientia tsutsugamushi, the vectors & pathogen of scrub typhus in rodents & shrews collected from Puducherry & Tamil Nadu, India. Indian Journal of Medical Research, 2016, 144.
27. Tilak R, Kunwar R, Tyagi PK, Anurag K, Joshi R, Wankhade UB *et al*. Zoonotic Surveillance for Rickettsiae in Rodents and Mapping of Vectors of Rickettsial Diseases in India: A Multi-centric Study, Indian journal of public health. 2017; (61):174-81.
28. Sadanandane C, Jambulingam P, Paily KP, Kumar NP, Elango A, Mary KA *et al*. Occurrence of Orientia tsutsugamushi, the Etiological Agent of Scrub Typhus in Animal Hosts and Mite Vectors in Areas Reporting Human Cases of Acute Encephalitis Syndrome in the Gorakhpur Region of Uttar Pradesh, India. Vector Borne Zoonotic Dis. 2018; 18(10):539-547