

Prevalence and distribution of chigger mites (Acari: Trombiculidae): A comprehensive review

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Abstract

A specialised biological vector of the zoonotic disease scrub typhus, chigger mites (Acari: Trombiculidae) are considered to be an important medicinal arthropod vector. The gram-negative bacterium *Orientia tsutsugamushi*, which causes disease, is carried by the larval stage of the chigger mite and has a distinct parasitism mechanism. The study aims to provide an overview of the prevalence and range of various vector mite species in world especially in India. After reviewing a number of study articles, it was discovered that chigger mites are spread over the world as ectoparasites of a variety of vertebrate hosts, including rodents, cattle, aves, and occasionally invertebrates. There are 700 hazardous species of mites known to exist worldwide, and 250 of those species are important for public health. There are 195 species of mites in 24 genera belonging to the subfamily trombiculinae of the trombiculide family that have been found in India which the tribes Trombiculini, Schoengastiini, and Gahrlipeini are linked to as animal hosts. In the renowned tsutsugamushi-triangle bordered areas, chigger mites are common. They are widely dispersed throughout practically the entire country of India.

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

Introduction

According to Goddard (2012), there are 700 hazardous species of mites known to exist worldwide, and 250 of those species are important for public health. (Hoy, 2012). Although larvae have three pairs of legs; all mites are hemimetabolous, minuscule parasitic organisms with four pairs of legs (Johnston, 1982; Evans, 1992). The mite superfamily Trombiculoidea (Acari: Acariformes) has greater significance in medicine (Shatrov and Kudryashova, 2006). There are 195 species of mites in 24 genera belonging to the subfamily trombiculinae of the trombiculide family that have been found in India which the tribes Trombiculini, Schoengastiini, and Gahrlipeini are linked to as animal hosts. Chiggers, a larval stage of trombiculide mites, are a vector for scrub typhus, a disease spread by rodent hosts and chiggers parasitise birds, mammals, reptiles, and sometimes arthropods. Chiggers are primarily located in and around the ears of their hosts and are typically discovered on animal parts that have come into touch with the ground.

A species of chigger mite known as *Leptotrombidium deliense* is the primary vector of scrub typhus, also known as tsutsugamushi disease. It is found throughout the world, but is most commonly associated with the Asia-Pacific region known as the Tsutsugamushi triangle, which includes the Philippines, northern Australia, South Korea, Japan, China, Thailand, India, Indonesia, and Taiwan. Out of all the chigger species found in India, *L. deliense* is the most common species responsible for the transmission of scrub typhus. Although it is still debatable, *Schoengastiella* sp. has also been proposed as a vector for the spread of scrub typhus. The vector chigger mites were restricted to the tsutsugamushi triangle, an approximately 13 million km²

geographical area. The region known as Tsutsugamushi extends from Japan in the east, via China, the Philippines, tropical Australia in the south, and India, Pakistan, and maybe Tibet and Afghanistan in the west, as well as the southern regions of the USSR in the north^[2]. However, it has been verified by current research that the vector species are being reported outside of the triangle confined zone. Chigger mites are thought to be a common ectoparasite worldwide, occurring in both tropical and subtropical areas. Chigger mites gradually settle on a defined region of soil known as "Mite Island," where the ecosystem is discovered to be favourable for mites. While mature mites do not feed, these mites only feed warm-blooded animal serum once during their life cycle. Scrub typhus disease's causal agents, or *Orientia tsutsugamushi*, are passed on by the ovarian way through mite progeny. Typically, a variety of mammals are affected by the scrub typhus disease, but field mice and rodents are more commonly affected^[3]. There are reports of its vector species originating from all twenty-nine states in India, with the exception of four Union Territories. Regarding this, NIV Pune has carried out a number of chigger surveys in various eco-geographical areas of India during the previous three decades, encompassing the Hill Districts of West Bengal, Rajasthan, Maharashtra, Goa, Orissa, Gujarat, and Karnataka; also included are the Western Himalayas and Sikkim.

Literature Review

The larval chigger Scrub typhus is spread by trombiculid mites. The primary hosts are shrews and rodents. An investigation into the various locations where chiggers were found in rodents and shrews showed that *Rattus rattus* 95 (63%) and *Suncus murinus* 33 (22%) were more common.

Suncus murinus 17(30%) and *Rattus rattus* 31(54%) by themselves contributed more to chigger positive. Eight species, divided into five genera, comprised chigger mites. 57 positive rodents yielded *Leptotrombidium deliense* (66%), *Schoengatiella ligula* (15%), and various chiggers (9%). The quantity of chiggers collected did not significantly alter seasonally, however there was a substantial difference in rodent positive. The study showed how common chiggers are in different hosts and how they differ in rodent and shrew hosts. *S. murinus* 17(30%) and *R. rattus* 31(54%) made contributions. [1]

Typically found as ectoparasites on rodents, chigger mites (Acari) are the only vector that spreads scrub typhus. Two sibling rodent species are the Lantsang field mouse (*A. ilex*) and the South China field mouse (*Apodemus draco*). This article compared the chigger infection of these two mouse species, based on field surveys conducted in southwest China between 2001 and 2015. 36 of the 42 chigger species detected on *A. draco*, 11 on *A. ilex*, and 5 common species on both mice were found to be present among the two mouse species. The Jaccard similarity index ($J = 0.12$, $J < 0.25$) revealed that the species composition of chiggers on two mouse species differed significantly, as did certain other aspects of the chigger community. *A. ilex* ($MI = 3.91$, $p < 0.05$) had a lower overall mean intensity of chiggers than *A. draco* ($MI = 4.26$). *Trombiculindus yunnanus*, *Leptotrombidium scutellare* (a prominent vector species in China), and *L. sinicum* were the leading chigger species on *A. draco*, with a total constituent ratio $Cr = 42.9\%$ (106/247). *A. draco* was the site of independent occurrences of *Leptotrombidium sinicum* and *L. scutellare*, with an association coefficient of $V = 0.09$ ($V \sim 0$). With a total $Cr = 58.14\%$ (25/43), *L. rusticum*, *L. densipunctatum*, and *L. gongshanense* were the three most common chigger species on *A. ilex*. A weak positive correlation was observed between *Leptotrombidium rusticum* and *Leptosombinia densipunctatum* on *A. ilex* ($V = 0.49$, $0.5 < V < 1$). Among various individuals of two mouse species, there was an unequal distribution of all prominent chigger species. [2]

The most well-known usage of "chiggers" (trombiculid mite larvae) is as carriers of *Orientia* spp., rickettsial infections that cause scrub typhus, a zoonosis. But a growing number of additional pathogens—including Dabie bandavirus, Hantaan orthohantavirus, Anaplasma species, Bartonella species, Borrelia species, and Rickettsia species—as well as bacterial symbionts—including *Cardinium*, *Rickettsiella*, and *Wolbachia*—are also being linked to chiggers. Here, we investigate possible relationships within this microcosm and the unexpectedly diversified chigger microbiota. Important findings include the possibility that chiggers carry viruses, the prevalence of unknown symbionts in some chigger populations across multiple bacterial families, and growing evidence of vertical transmission of potential pathogens and symbiotic bacteria in chiggers, indicating close interactions rather than haphazard bacterial acquisition from the environment or host. [3]

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. [13]



Fig 1: Chigger (larva of trombiculid mite)



Fig 2: Chigger mite

Conclusion

In terms of global public health, chigger mites (*Leptotrombidium*) are regarded as significant vectors. Based on numerous studies, it has been determined that chigger mites are not limited to a certain area; they can also inhabit areas outside of the traditional Tsutsugamushi triangle. Furthermore, high chigger index cases have been documented throughout India. There are 700 hazardous species of mites known to exist worldwide, and 250 of those species are important for public health. There are 195 species of mites in 24 genera belonging to the subfamily trombiculinae of the trombiculide family that have been found in India which the tribes Trombiculini, Schoengastiini, and Gahrlepiini are linked to as animal

hosts. There are 204 different species of chigger mites known to exist in India. These species are primarily found in the country's tribal belt, which spans nine states and includes the states of Rajasthan, Gujrat, Andhra Pradesh, Odisha, Madhya Pradesh, Chhattisgarh, West Bengal, and Jharkhand. Tamil Nadu and Puducherry reported the highest chigger index. There have also been reports of vector mites in Jammu & Kashmir, Vellore, Sikkim, Nagaland, Darjeeling, and Manipur in India.

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