

Preplanned Studies

Distribution of Triatomines, the Vector of Chagas Disease — Southern China, 2016–2018

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Summary

What is already known on this topic?

Triatomines, also known as kissing bugs, are widespread vectors for Chagas disease which affects 6–8 million people worldwide. Two species of triatomines have been previously reported in China.

What is added by this report?

This study showed data from the first investigation of triatomine distribution in China. *Triatoma rubrofasciata* and a novel species of triatomine in 170 habitats in 30 cities in southern China were recorded in this investigation.

What are the implications for public health practice?

Considering the worldwide spread of Chagas disease and new species of trypanosomiasis, strengthening the monitoring of triatomines and their associated diseases in southern China is vital to prevent and control these diseases.

Triatomines, also known as kissing bugs, are widespread vectors for Chagas disease that affects 6–8 million people worldwide (1). Although two species of triatomines were recorded in China thirty years ago, there has been little research on them. Due to the increasing risk of the global spread of Chagas disease, triatomines have become a potential public health threat (2) and have begun being monitored in southern China. Social media tools including WeChat and QQ were used to allow local people to report cases after being educated on triatomines. All the samples and data were sent to the National Institute of Parasitic Diseases (NIPD) of China CDC and were reviewed by experts. *Triatoma rubrofasciata* (*T. rubrofasciata*) and a novel species of triatomine in 170 habitats in 30 cities in southern China were recorded in this investigation and 99.42% (1,035/1,041) of them were detected around human residences. Since triatomines have been found throughout southern China, continuous surveillance is crucial for public health.

The data of this study was collected from July 2016 to December 2018. First, a questionnaire and promotional literature were displayed to the county-level CDC staff and village doctors to determine the presence of triatomines in suspected distribution areas in 54 cities and 309 counties (counties are subdivisions of prefecture-level cities) in the provincial-level administrative divisions (PLADs) of Guangxi, Guangdong, Hainan, Fujian, and Yunnan. Second, social media tools including WeChat and QQ were used to publicize and popularize information on triatomines and allow locals to collect and report triatomine samples. Local staff were then trained to identify the species of the samples and to ensure consistent quality. Information including time, location, developmental stage, and sex of the samples was recorded. Light traps and Noireau traps were used to collect triatomines in the field (3–4). Finally, all samples and data were sent to the NIPD of China CDC for further verification and aggregation. The morphological identification of the triatomines that was conducted referred to Xiao et al. (1981) and Lent et al. (1979) (5–6).

A total of 1,042 triatomines, 81.96% (854/1,042) of which were adults and 18.04% (188/1,042) were nymphs, were captured from 170 different sites in 67 counties in 30 cities. Among them, 1,041 triatomines were identified as *T. rubrofasciata* (Figure 1A, 1B) based on morphology and were captured from 169 different sites distributed in 66 counties of 29 cities in the PLADs of Guangxi, Guangdong, Hainan, and Fujian. This result was far beyond historical records of *T. rubrofasciata* from 15 different sites in 13 counties of 11 cities before 2016 in museums and the literature (Figure 2A, 2B).

A female specimen (Figure 1C, 1D) was captured in Dali Prefecture, Yunnan Province, which was different from the other recorded triatomines in both on morphology and molecular data. This triatomine was different from *T. rubrofasciata* and *T. sinica* (5), which are often recorded in China, and had the following

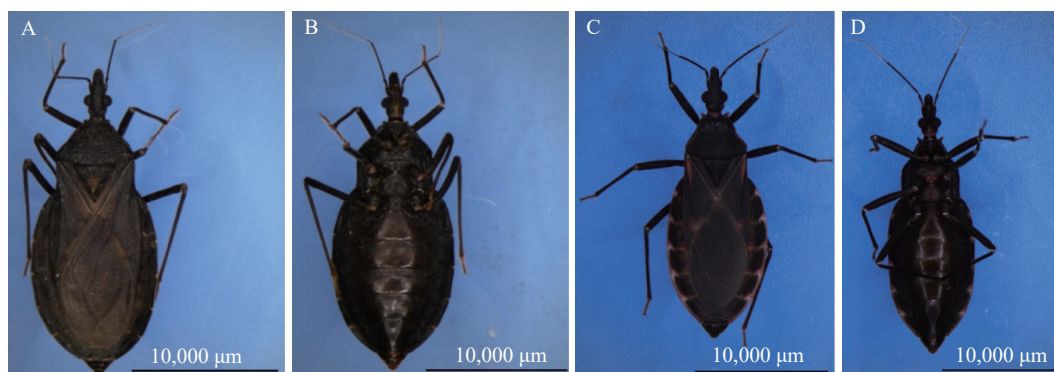


FIGURE 1. Morphology views of the triatomines captured in China. (A) Dorsal view of the female specimen for *T. rubrofasciata* captured in Shunde District, Foshan City, Guangdong Province; (B) Ventral view of the female specimen for *T. rubrofasciata* captured in Shunde District, Foshan City, Guangdong Province; (C) Dorsal view of female specimen for the novel species of *Triatoma* sp. captured in Dali Prefecture, Yunnan Province; (D) Ventral view of female specimen for the novel species of *Triatoma* sp. captured in Dali Prefecture, Yunnan Province.

main morphological differences: 1) darker color, no obviously orange-red or orange-yellow markings; 2) first antennal segment not exceeding tip of head; 3) smaller and shorter synthlipsis; 4) the scutellum was rough and wrinkled, the top of it was slightly upwarping with oblique uplift in the center of both sides (Figure 1C, 1D). The 16S ribosomal RNA (16S rRNA) gene, the cytochrome b gene, and the 28S ribosomal RNA with the highest similarities to *T. rubrofasciata* in GenBank showed only 93.08%, 77.16%, and 91.55% similarity, respectively. Sequences obtained from 16S rRNA of the Dali species were submitted to GenBank under the accession number MN200191 and the phylogenetic trees were constructed by the 16S rRNA gene of triatomines using the neighbor-joining method by MEGA (Molecular Evolutionary Genetics Analysis Version 6.0. Tamura K, Stecher G, Peterson D, Filipski A, and Kumar S, 2013). The result showed that this triatomine belonged to Triatominae and in the same clade of *T. rubrofasciata* (Figure 3). Based on the morphological and molecular data, the result showed that this could be a novel species of triatomine.

Among these *T. rubrofasciata* samples, 305 triatomines were captured from 54 different sites in 29 counties of 13 cities in Guangxi, 280 from 97 different sites in 27 counties of 9 cities in Guangdong, 419 from 11 different sites in 4 counties of 4 cities in Hainan, and 37 from 7 different sites in 6 counties in 3 cities in Fujian. On average, about 6.16 triatomine bugs were collected at each site. Among them, 43.80% (456/1,041) were female, 38.14% (397/1,041) were male, and 18.06% (188/1,041) were nymphs. Meanwhile, 99.42% (1,035/1,041) of the specimens

were collected inside human housing and animal housing (which were around human housing), among which 60.90% (634/1,041) were collected inside human housing. Only 0.58% (6/1,041) were collected in the environment surrounding human housing, and 74.92% (780/1,041) were captured in July and August with 94.81% (987/1,041) of the total being captured from May to October. It should be noted that triatomines infestations were found in all months except January in Hainan Province.

DISCUSSION

Although triatomines were public health nuisances worldwide, little research on triatomines was recorded in China before 2016. Our investigation showed that *T. rubrofasciata* was widely found in Guangdong, Fujian, Hainan, and Guangxi, and 169 habitats were recorded in this study. The widespread distribution of *T. rubrofasciata* found in our study exceeded the sporadic existing records found in museums and in the literature. For example, in Guangxi, *T. rubrofasciata* was captured in 13 out of 14 prefecture-level cities; Guilin City was the only exception (7). For this report, this insect presented dispersion favored by interactions with residential settlements and human activities (8). In this study, all samples were collected by local residents around their settlements, and field environments were also investigated by light traps and Noireau traps but no samples were collected. This result further showed its tendencies for human interaction, which was consistent with findings from Hieu et al. (9).

T. rubrofasciata causes allergic reactions by through

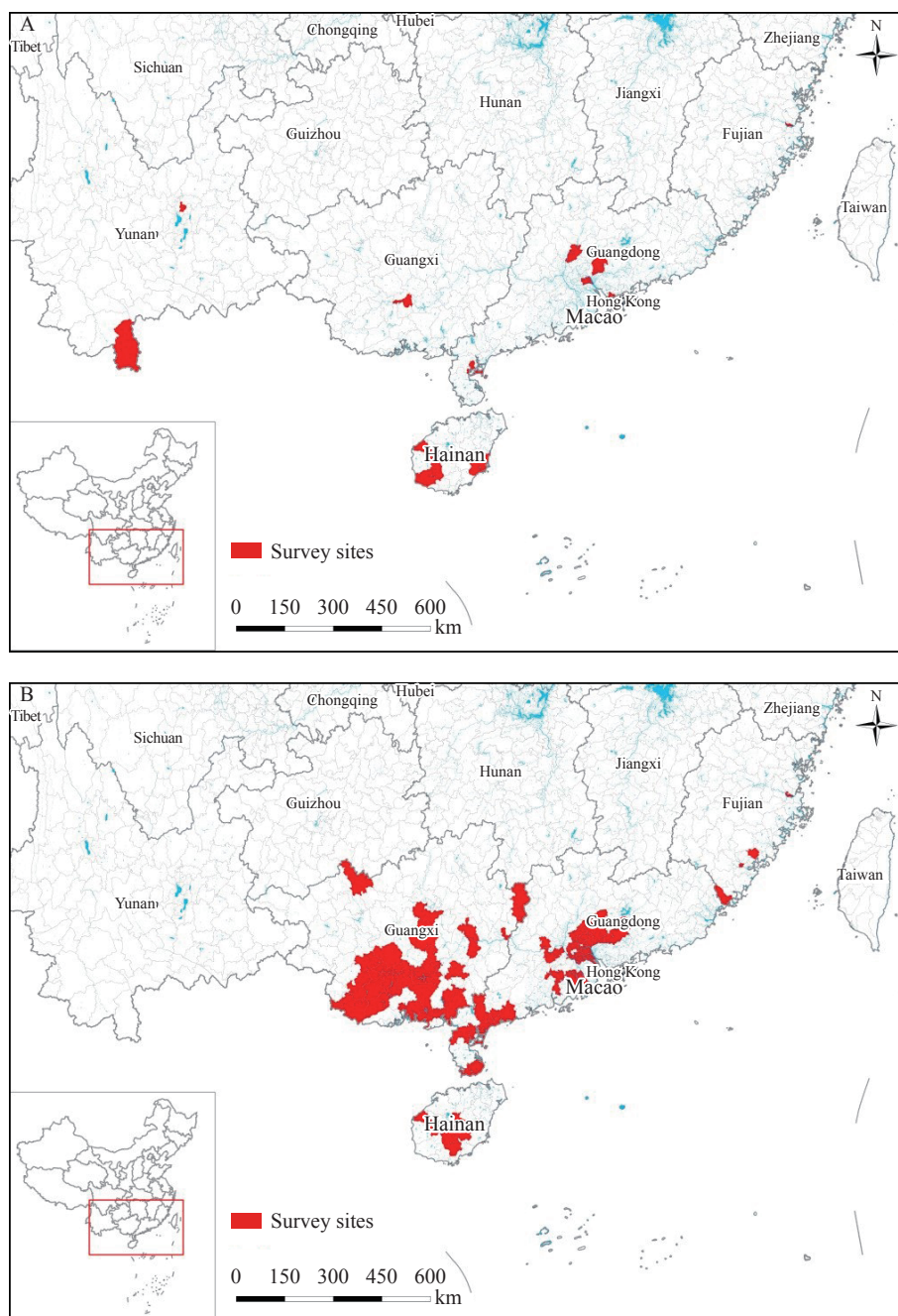


FIGURE 2. A comparison of the distribution data for *T. rubrofasciata* in southern China between (A) historical records and (B) current records.

bites and consuming blood and also spreads many diseases including having been confirmed to transmit *T. cruzi* – the pathogen of Chagas disease that has reached global spread (1). *T. rubrofasciata* can also transmit *T. conorhini* and *T. lewisi*, and several cases of human infection by *T. lewisi*, including fatal ones, have been reported in India where *T. rubrofasciata* has been found (9–10). Due to its tendencies to interact with human settlements and areas of human activity, its distribution in southern China highlights the need to

enhance monitoring of this vector and its transmissible diseases.

This study was subject to several limitations. First, multiple methods were used to survey triatomines, but manual collection showed the highest effectiveness in this study. Manual collection meant that only visible samples exposed to human environments could be collected, which would result in sample omission and a lower-than-projected density of triatomines. Second, the lack of a mandatory reporting system implied lower

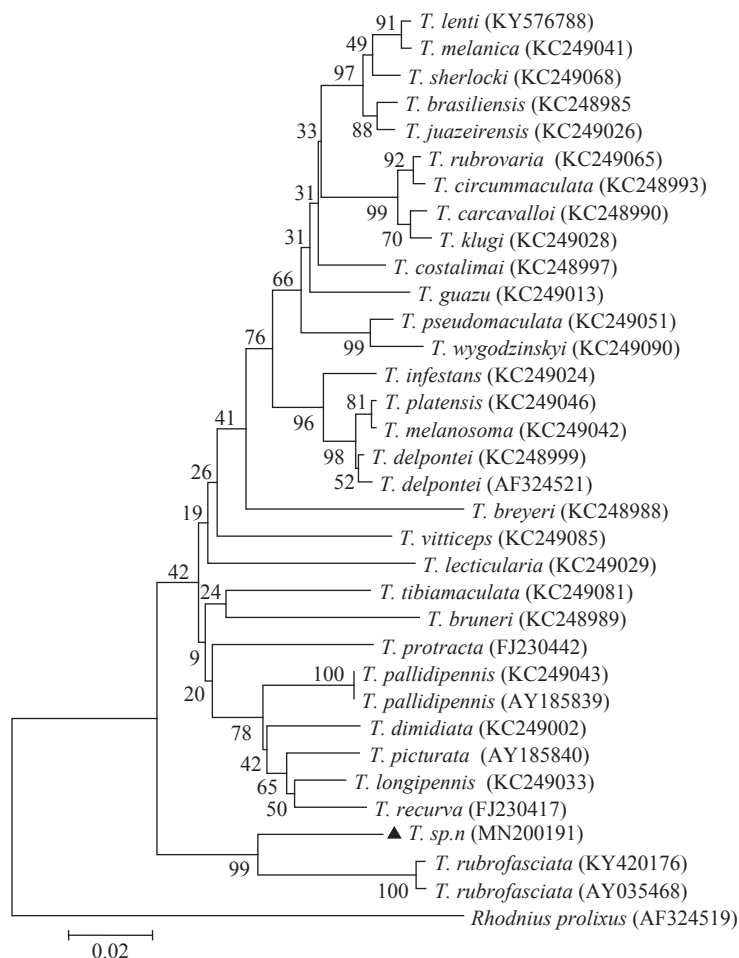


FIGURE 3. Phylogenetic tree showing the relationships between the Dali triatomine (MN200191) and other Triatominae species.

data quality as some habitat sites would likely be underrepresented. For example, some *T. rubrofasciata* habitat records were not found in this study, such as historical reports in Yunnan Province that were not corroborated in this study. This issue requires future studies and the development of new effective methods to actively monitor triatomines and achieve control of this vector and its disease transmission.

More habitats will likely be found in southern China as surveillance continues. Because Chagas disease and other new trypanosomiasis have been found worldwide, we strongly suggest that the public health sectors should pay more attention to this vector and its associated diseases. The new records of adults and nymphs of triatomines in urban environments and around human settlements suggests the adoption of prophylactic measures for vector surveillance in southern China. Meanwhile, further studies are needed to determine triatomine biology, genetic variations, living habits, and their transmissible diseases in order

to better control these vectors.

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