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Distribution and infestation of gamasid mite *Laelaps echidninus* (Mesostigmata: Laelapidae) on small mammals across five provincial regions of southwest China

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ABSTRACT

This study investigated the distribution and infestation patterns of the gamasid mite *Laelaps echidninus* (Mesostigmata: Laelapidae) on small mammals in southwest China to provide a scientific basis for the surveillance of mite-borne zoonoses. Prevalence (P_M), mean abundance (*MA*), and mean intensity (*MI*) were calculated, and Taylor's power law was applied to characterize the spatial distribution pattern. A total of 38,423 *L. echidninus* mites were collected from 4,351 small mammals representing 29 species, with 99.65% recovered from rodents. *Rattus nitidus* exhibited the highest P_M (67.35%) and *MA* (9.33 mites per host) ($P < 0.001$). Male, and adult hosts showed significantly higher infestation indices, particularly *MI*, than female, and juvenile hosts ($P < 0.05$), respectively. Infestation varied markedly among environments. Adult females, and adults greatly outnumbered males, and juveniles, respectively, and the mite population displayed an aggregated distribution among hosts. *Laelaps echidninus* is widely distributed in southwest China, with rodents as its primary hosts; host sex- and age-related biases, together with environmental heterogeneity, strongly influence infestation dynamics, with adult females dominating the mite population.

KEYWORDS

Acari, gamasid mite, *Laelaps echidninus*, ectoparasite, small mammal, southwest China

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INTRODUCTION

Laelaps echidninus Berlese, 1887 is a species of gamasid mite, and it belongs to the genus *Laelaps*, family Laelapidae, superfamily Dermanyssoidea, order Mesostigmata, superorder Parasitiformes, subclass Acari, class Arachnida in zootaxonomy (Bandyopadhyay *et al.* 2023). Gamasid mites constitute a large and diverse group of arthropods, with more than 8,000 species described worldwide. Their typical life cycle comprises five developmental stages: egg, larva, protonymph, deutonymph, and adult (male and female). Ecologically, gamasid mites include both free-living and parasitic forms. Free-living species occur in a wide range of habitats, including soil, humus, leaf litter, refuse sites, and animal nests, whereas parasitic species may be obligate or facultative, occurring as endoparasites or ectoparasites. Among them, ectoparasitic gamasid mites represent the dominant parasitic group. These mites exploit a broad host range, with rodents and other small mammals (e.g., shrews and tree shrews) serving as the most important hosts (Yin *et al.* 2021; Zhou *et al.* 2022). Some species of ectoparasitic gamasid mites can act as vectors or potential vectors of zoonotic pathogens. Rodents and other wild animals serve as important sources of infection and reservoir hosts for many zoonoses. Through their blood-feeding activity, gamasid mites can transmit pathogens among rodents and other wild animals and, in some cases, from wildlife to humans (Guo *et al.* 2016; Liu *et al.* 2020).

As a globally distributed gamasid mite species, *Laelaps echidninus* commonly occurs on the body surface of rodents and other small mammals as a facultative ectoparasite. As a widespread and common species, it is frequently found both on its small mammal hosts (primarily rodents and other small mammals) and in their nests. In addition to invading and biting humans and causing dermatitis, *L. echidninus* has been implicated as a potential vector and reservoir host of hemorrhagic fever with renal syndrome (HFRS). Moreover, *L. echidninus* may also serve as a potential vector and reservoir host of other zoonoses, such as plague, scrub typhus, murine typhus, Q fever, and leptospirosis, as their corresponding pathogens have been detected in this mite species (Selmi *et al.* 2021).

Southwest China, a vast region encompassing five provincial administrative units, is an important endemic focus of HFRS and several other zoonoses (Chen *et al.* 2023; Guo *et al.* 2023). Therefore, studies on *L. echidninus* and other vector gamasid mites in this region are of considerable medical significance. Based on a series of field investigations and taxonomic identification of abundant specimens collected from 122 survey sites across southwest China between 1990 and 2024, the present study documents the distribution and infestation patterns of *L. echidninus* on rodents and other sympatric small mammals in the region. This study aims to improve the understanding of this gamasid mite species and to provide scientific evidence to support future research as well as the surveillance and control of related zoonotic diseases.

MATERIAL AND METHODS

Collection and identification of gamasid mites and their small mammal hosts

The original data was obtained from a long-term field investigation conducted at 122 survey sites across five provincial regions of southwest China (97° 21'–110° 11' E, 21° 08'–33° 41' N) between 1990 and 2024, including Yunnan, Guizhou, Sichuan, Chongqing, and Xizang (Tibet). In Xizang, surveys were restricted to the eastern part of the region, as the western area is vast and sparsely populated, with limited transportation accessibility, hypoxic conditions, and increased potential risks associated with high-altitude environments. In addition, constraints in human resources and financial support prevented coverage of the entire territory of Xizang (Fig. 1).

At each survey site, mousetraps (18 × 12 × 9 cm; Lee's Rodent Control Equipment Co. Ltd. or Guixi Mousetrap Apparatus Factory, Guixi, Jiangxi, China) baited with various attractants were deployed to capture rodents and other sympatric small mammals (e.g., shrews and tree shrews) across different habitats, including indoor environments (houses, stables, barns, and surrounding areas) and outdoor environments (farmlands, bushes, and woodlands). To optimize capture efficiency, baits were adjusted according to habitat type: corn and peanuts were typically used in outdoor habitats, whereas steamed bread and fried dough were commonly used indoors.

Gamasid mites present on the body surface of hosts were collected using conventional methods (Peng *et al.* 2018a). Each animal host was identified to species level based on morphological characteristics (Wilson and Reeder 2005). Collected mites were mounted on glass slides using Hoyer's medium. After dehydration, clearing, and drying, mite specimens were identified to species under a microscope (Olympus Corporation, Tokyo, Japan) according to relevant taxonomic literature and identification keys (Pan and Deng 1980; Deng *et al.* 1993; Jacinavicius *et al.* 2013). Based on the taxonomic identification, *Laelaps echidninus* was selected as the focal species of the present study. Voucher specimens are deposited in the specimen repository of the Institute of Pathogens and Vectors, Dali University.

All procedures involving animal capture and use were approved by the local wildlife affairs authority and the Ethics Committee of Dali University.

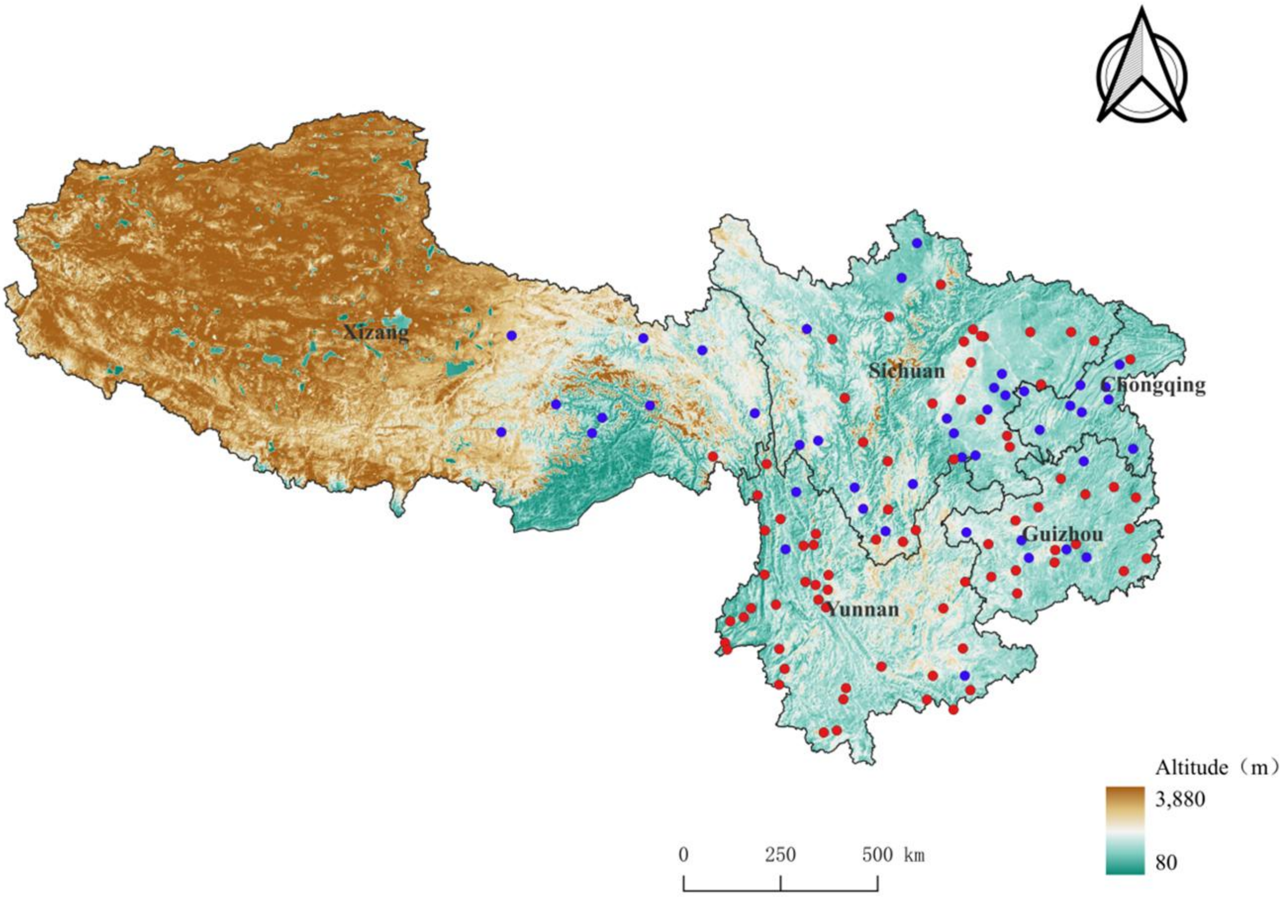

Figure 1. Field investigation sites and distribution of *Laelaps echidninus* across the five provincial regions of southwest China (1990–2024). **Annotation:** The "●" circles represent 44 negative sites where no *L. echidninus* mite was found, and "●" represent 78 positive sites where *L. echidninus* mites were collected.

Statistical analysis

The constituent ratio (C_r) was used for calculating the percentage of *L. echidninus* mites on its small mammal hosts. The prevalence (P_M), mean abundance (*MA*) and mean intensity (*MI*) were used for the percentage of infested hosts with mites, the average number of mites per examined host and the average number of mites per infested host (Bush *et al.* 1997; Guo *et al.* 2006).

Taylor's power law was used for determining the spatial distribution pattern of *L. echidninus* mites among different individuals of hosts. Taylor's power law is expressed by the following formula (Taylor 1961),

$$\text{Taylor's power law:} \quad \lg \sigma^2 = \lg a + b \lg m$$

where, σ^2 = variance, m = mean, a = intercept, and b = slope (regression coefficient). When $a = 1$ and $b = 1$ or $\lg a > 0$ and $b = 1$, the spatial distribution of *L. echidninus* was determined as random distribution among different hosts, and when $a > 1$ and $b \geq 1$ or $\lg a > 0$ and $b > 1$, the spatial distribution was determined as aggregated distribution (Wu *et al.* 2019).

Based on Taylor's power law, the following formulae were used to establish a function relationship between the prevalence (P_M) and mean abundance (*MA*) (Zuo and Guo 2011).

$$P_M = 1 - \left(1 + \frac{MA}{k}\right)^{-k}; \quad 1/k = aMA^{(b-2)} - \frac{1}{MA} \quad \text{or} \quad k = \frac{MA^2 - \left(\sigma^2/n\right)}{\sigma^2 - MA}$$

In the above formulae, *k* represents the degree of aggregation, and *n* is the number of host samples used in the calculation of *MA*. Parameters *a* (intercept) and *b* (slope) are the same as in Taylor's power law.

RESULTS

Distribution and overall infestation of **L. echidninus** *in southwest China*

From 1990 to 2024, a total of 211,312 gamasid mites were collected from the body surface of 24,654 small mammal hosts at 122 survey sites across the five provincial regions of southwest China. Of 211,312 gamasid mites collected, 207,946 mites were identified as 212 species, 46 genera and 15 families. Due to structural damage, dirt covering, unclear structure or suspected new species, 3,366 mites could not be identified to species level and they were recorded as "unidentified specimens". Among 122 survey sites, 38,423 *L. echidninus* mites were found at 78 positive sites where a total of 20,753 small mammal hosts were captured with 4,351 hosts infested with *L. echidninus*. At 44 negative sites, 3,901 small mammal hosts were captured and no *L. echidninus* was identified from these hosts. Of 212 gamasid mite species (207,946 individuals) identified from 122 survey sites of the entire southwest China, *Laelaps nuttalli* (C_r = 19.93%, 41,447/207,946) was the most abundant mite species, and the numbers of *L. echidninus* (C_r = 18.48%, 38,423/207,946) were second only to *L. nuttalli*. Of the identified 38,423 *L. echidninus* mites, 68.93% were from Yunnan (C_r = 68.93%, 26,484/38,423), 17.96% from Sichuan (C_r = 17.96%, 6,902/38,423), 12.87% from Guizhou (C_r = 12.87%, 4,946/38,423), 0.21% from Xizang (C_r = 0.21%, 79/38,423), and 0.03% from Chongqing (C_r = 0.03%, 12/38,423) (Fig. 1). The overall infestation indices of *L. echidninus* on its small mammal hosts at 78 positive sites were: P_M = 20.97%, *MA* = 1.85 mites/per examined host, and *MI* = 8.83 mites/per infested host.

Host selection of **L. echidninus**

The 4,351 small mammal hosts from which 38,423 *L. echidninus* mites were collected belonged to six families, 15 genera, and 29 species across three orders (Rodentia, Eulipotyphla, and Scandentia). Table 1 presents the 29 host species infested with *L. echidninus* and the number of mites recorded from each species throughout southwest China between 1990 and 2024. At the host order level, the vast majority of *L. echidninus* mites (constituent ratio, C_r = 99.65%, 38,290/38,423) were collected from Rodentia. At the family and genus levels, 98.89% and 71.00% of mites were associated with the family Muridae (C_r = 98.89%, 37,995/38,423) and the genus *Rattus* (C_r = 71.00%, 27,282/38,423), respectively. At the species level, 29.40%, 28.48%, and 12.02% of mites were collected from *Rattus tanezumi* (11,296/38,423), *R. nitidus* (10,942/38,423), and *R. norvegicus* (4,619/38,423), respectively, with a combined C_r of 69.90% for these three species (Fig. 2; Table 2). Among the 29 host species, *R. nitidus* exhibited the highest prevalence (P_M = 67.35%) and mean abundance (*MA* = 9.33 mites per examined host) ($P < 0.001$) (Table 2).

The infestation indices of *L. echidninus* varied with host sex and age. Most mites were collected from male hosts, which exhibited higher *MA* and *MI* than females, except for P_M. Furthermore, 84.24% of mites were collected from adult hosts (C_r = 84.24%), with significantly higher *MA* and *MI* observed in adults compared with juveniles, except for P_M (Fig. 3; *MI*: $P < 0.05$).

Table 1. The 29 species of small mammal hosts infested with *Laelaps echidninus* mites and the number of the mites on each host species in southwest China (1990–2024).

Names of small mammal hosts	No. of hosts	No. of *L. echidninus*	Names of small mammal hosts	No. of hosts	No. of *L. echidninus*
Rattus tanezumi	2128	11296	***Mus caroli***	29	49
Rattus nitidus	790	10942	***Mus musculus***	13	27
Rattus norvegicus	536	4619	***Mus pahari***	11	25
Rattus tanezumi	2128	11296	***Mus caroli***	29	49
Rattus nitidus	790	10942	***Mus musculus***	13	27
Rattus nitidus	790	10942	***Mus musculus***	13	27
Rattus norvegicus	536	4619	***Mus pahari***	11	25
Rattus andamanensis	86	425	***Berylmys***	2	73

Table 1. Continued.

Names of small mammal hosts	No. of hosts	No. of *L. echidninus*	Names of small mammal hosts	No. of hosts	No. of *L. echidninus*
Niviventer confucianus	318	4168	***Berylmys berdmorei***	2	11
Niviventer fulvescens	233	3845	***Micromys erythrotis***	7	21
Niviventer lotipes	48	1218	***Eothenomys miletus***	19	291
Niviventer huang	37	538	***Callosciurus***	1	4
Niviventer andersoni	10	29	***Anourosorex***	11	84
Apodemus chevrieri	34	395	***Crocidura attenuata***	6	15
Apodemus agrarius	3	4	***Crocidura dracula***	1	13
Apodemus latronum	1	1	***Suncus murinus***	10	16
Apodemus draco	1	1	***Hylomys suillus***	1	1
Bandicota indica	5	204	***Tupaia belangeri***	4	4
Leopoldamys edwardsi	4	104	**Total**	4,351	38,423

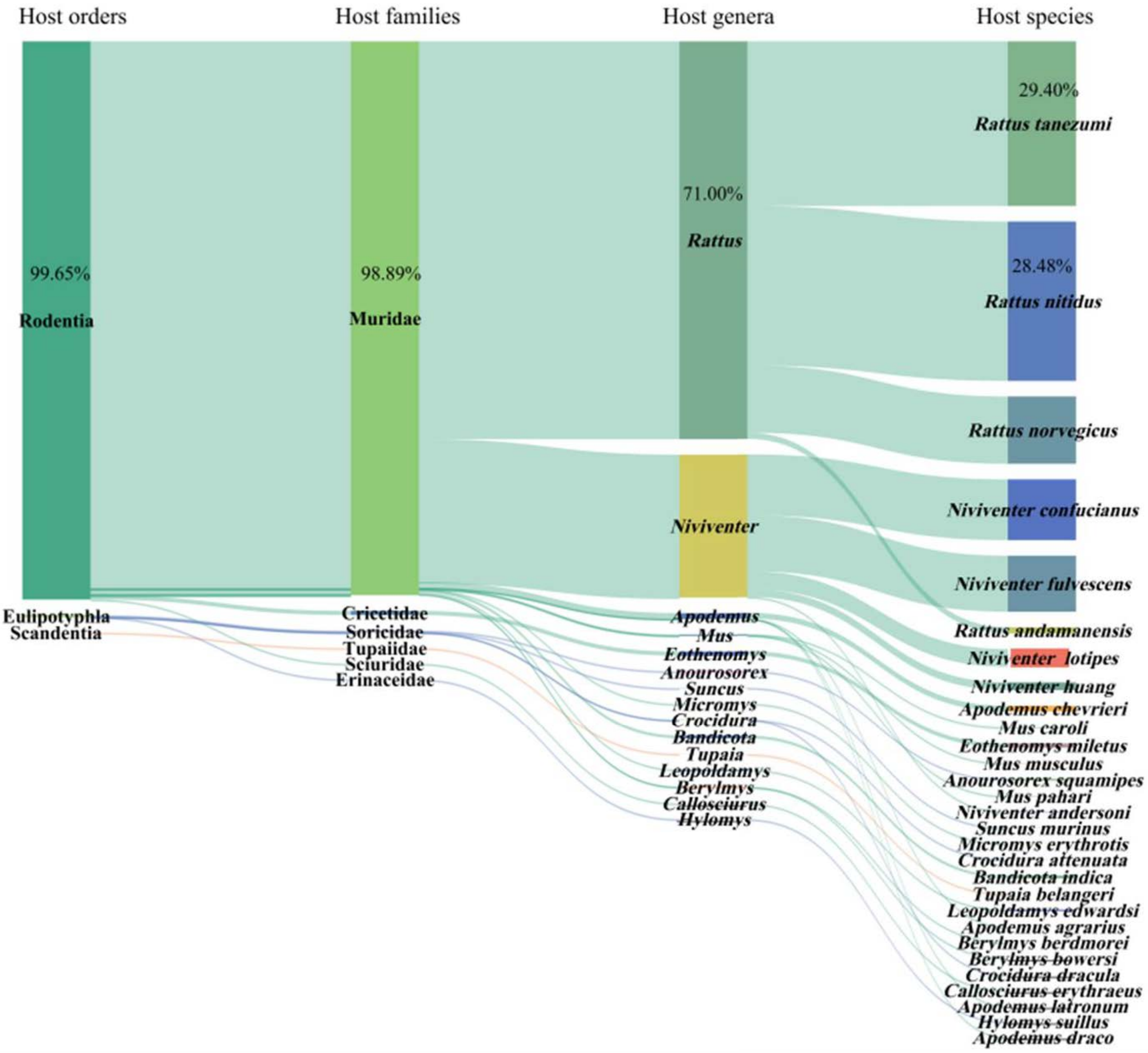

Figure 2. The visualization of constituent ratios (C_r) of 38,423 *Laelaps echidninus* mites among different orders, families, genera, and species of hosts (4,351 small mammal hosts) in southwest China (1990–2024). **Annotation:** The shade width indicates the constituent ratio (C_r) of *L. echidninus* mites on a certain order, family, genus, or species of the host.

Table 2. Infestation indices of *L. echidninus* mites on the main species of hosts in southwest China (1990–2024).

Host names	No. of hosts		No. and C_r of *L. echidninus*		Infestation indices of *L. echidninus* on hosts		
	Examined	Infested	No.	C_r (%)	P_M (%)	*MA*	*MI*
R. tanezumi	5543	2128	11296	29.40	38.39	2.04	5.31
R. nitidus	1173	790	10942	28.48	67.35	9.33	13.85
R. norvegicus	1684	536	4619	12.02	31.83	2.74	8.62
N. confucianus	837	318	4168	10.85	37.99	4.98	13.11
N. fulvescens	521	233	3845	10.01	44.72	7.38	16.50
Other hosts species	10995	346	3553	9.25	3.15	0.32	10.27
Total	20753	4351	38423	100.00	20.97	1.85	8.83

Annotation: C_r = constituent ratio (%), P_M = prevalence (%), *MA* = mean abundance (mites/per examined rat host), and *MI* = mean intensity (mites/per infested rat host).

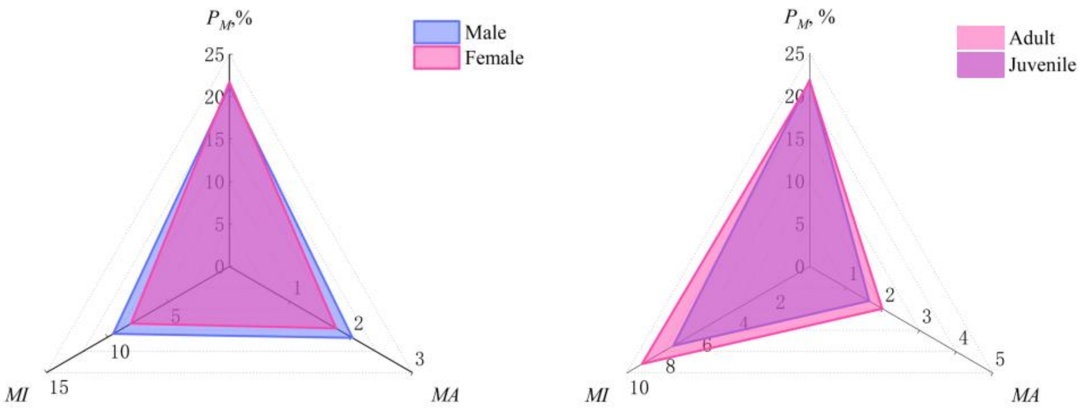

Figure 3. Radar chart visualization of *L. echidninus* infestation indices on different sexes and ages of small mammal hosts in southwest China (1990–2024).

Infestation variations of L. echidninus in different environments

The infestation indices of *L. echidninus* mites on the hosts varied in different environments. Along different latitude gradients (Table 3), *L. echidninus* had the highest P_M (67.42%) and *MA* (5.00) at > 33° N, and the highest *MI* (18.99) at 30–32° N ($P < 0.001$). Along different longitude gradients (Table 4), *L. echidninus* had the highest P_M (60.76%) and *MA* (8.11) at > 109° E, and the highest *MI* (21.53) at 100–102° E ($P < 0.001$). Along different altitude gradients (Table 5), *L. echidninus* had the highest P_M (33.82%) and *MA* (2.77) at 501–1500 m, and the highest *MI* (18.72) at > 2500m ($P < 0.05$). In different landscapes (Table 6), the P_M and *MA* of *L. echidninus* in the flatland landscape (P_M = 30.53% and *MA* = 2.43) were higher than those in the mountainous landscape, but the *MI* in the mountainous landscape (*MI* = 11.32) was higher than that in the flatland landscape ($P < 0.001$). In different habitats (Table 7), most *L. echidninus* mites came from the outdoor habitat (C_r = 87.24%) with higher *MA* (1.98) and *MI* (9.86), but lower P_M (20.10) than in the indoor habitat ($P < 0.001$).

Table 3. Infestation indices of *L. echidninus* mites on small mammal hosts along different latitude gradients in southwest China (1990–2024).

Latitude gradients	No. of hosts		No. and C_r of *L. echidninus* mites		Infestation indices of *L. echidninus*		
	Examined	Infested	No.	C_r (%)	P_M (%)	*MA*	*MI*
24–26° N	1309	226	3146	26.62	17.27	2.40	13.92
27–29° N	1033	210	2145	18.15	20.33	2.08	10.21
30–32° N	1587	309	5867	49.64	19.47	3.70	18.99
> 33° N	132	89	660	5.58	67.42	5.00	7.42
Total	4061	834	11818	100.00	20.54	2.91	14.17

Annotation: C_r, P_M, *MA* and *MI*, the same as in Table 2.

Table 4. Infestation indices of *L. echidninus* mites on small mammal hosts along different longitude gradients in southwest China (1990–2024).

Longitude gradients	No. of hosts		No. and C_r of *L. echidninus* mites		Infestation indices of *L. echidninus*		
	Examined	Infested	No.	C_r (%)	P_M (%)	*MA*	*MI*
97–99° E	480	122	956	8.09	25.42	1.99	7.84
100–102° E	477	85	1830	15.48	17.82	3.84	21.53
103–105° E	1891	333	4600	38.92	17.61	2.43	13.81
106–108° E	1139	246	3791	32.08	21.60	3.33	15.41
> 109° E	79	48	641	5.42	60.76	8.11	13.35
Total	4066	834	11818	100.00	20.51	2.91	14.17

Annotation: C_r, P_M, *MA* and *MI*, the same as in Table 2.

Table 5. Infestation indices of *L. echidninus* mites on small mammal hosts along different altitude gradients in southwest China (1990–2024).

Longitude gradients	No. of hosts		No. and C_r of *L. echidninus* mites		Infestation indices of *L. echidninus*		
	Examined	Infested	No.	C_r (%)	P_M (%)	*MA*	*MI*
≤ 500m	1308	308	3409	12.32	23.55	2.61	11.07
501–1500m	5145	1740	14238	51.46	33.82	2.77	8.18
1501–2500m	4233	783	7979	28.84	18.50	1.88	10.19
> 2500m	3001	109	2040	7.37	3.63	0.68	18.72
Total	13687	2940	27666	100.00	1.29	11.53	63.05

Annotation: C_r, P_M, *MA* and *MI*, the same as in Table 2.

Table 6. Infestation indices of *L. echidninus* mites on small mammal hosts in different landscapes in southwest China (1990-2024).

Landscapes	No. of hosts		No. and C_r of *L. echidninus* mites		Infestation indices of *L. echidninus*		
	Examined	Infested	No.	C_r (%)	P_M (%)	*MA*	*MI*
Flatland	6440	1966	15662	45.40	30.53	2.43	7.97
Mountainous	9105	1664	18835	54.60	18.28	2.07	11.32
Total	15545	3630	34497	100.00	23.35	2.22	9.50

Annotation: C_r, P_M, *MA* and *MI*, the same as in Table 2.

Table 7. Infestation indices of *L. echidninus* mites on small mammal hosts in different habitats in southwest China (1990–2024).

Habitats	No. of hosts		No. and C_r of *L. echidninus* mites		Infestation indices of *L. echidninus*		
	Examined	Infested	No.	C_r (%)	P_M (%)	*MA*	*MI*
Indoor	3817	953	4903	12.76	24.97	1.28	5.14
Outdoor	16909	3398	33520	87.24	20.10	1.98	9.86
Total	20726	4351	38423	100.00	20.99	1.85	8.83

Annotation: C_r, P_M, *MA* and *MI*, the same as in Table 2.

Sex ratio, age structure and spatial distribution pattern of L. echidninus

The sex ratio of *L. echidninus* showed a strong female bias, with female mites accounting for the vast majority (C_r = 97.27%, 36,152/37,165) compared to males (C_r = 2.73%, 1,013/37,165). In terms of age structure, adult mites predominated, while juveniles (larvae, protonymphs, and deutonymphs) comprised only 3.27% of the total population (C_r = 3.27%, 1,258/38,423) (Fig. 4). After logarithmic transformation, the linear regression of Taylor's power law was expressed as $\lg\sigma^2 = 1.58 + 1.01 \lg m$ ($\lg a = 1.58$, $b = 1.01$, $R^2 = 0.88$, $P < 0.05$), where both $\lg a$ and b exceeded the threshold values for aggregated distribution ($\lg a > 0$ and $b > 1$), indicating that *L. echidninus* exhibits a highly aggregated spatial distribution among hosts (Table 8, Fig. 5).

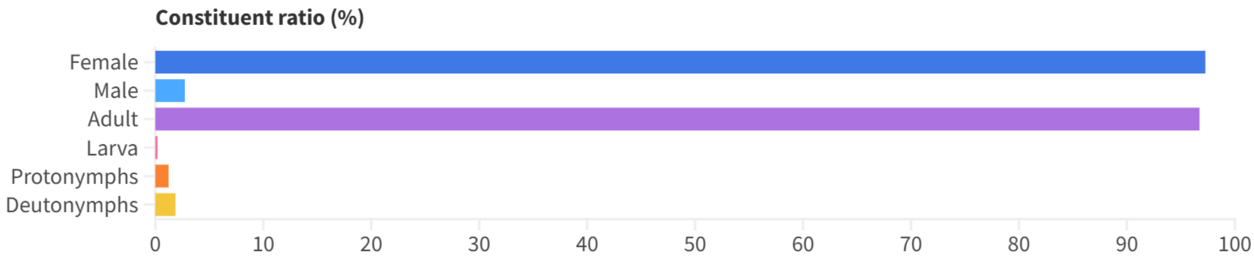

Figure 4. Bar charts for visualizing the sex ratio and age structure of *L. echidninus* in southwest China (1990–2024).

Table 8. Corresponding parameters of *L. echidninus* mites in establishing the linear regression equation of Taylor's power function.

Main species of hosts (host samples)	Mean of mites (m)	Variance of mites (σ^2)	lg$m$	lgσ^2
R. tanezumi	2.04	31.15	0.31	1.49
R. nitidus	9.33	372.68	0.97	2.57
R. norvegicus	2.74	147.40	0.44	2.17
N. confucianus	4.98	244.82	0.70	2.39
N. fulvescens	7.38	309.79	0.87	2.49
Other host species	0.32	15.55	−0.49	1.19

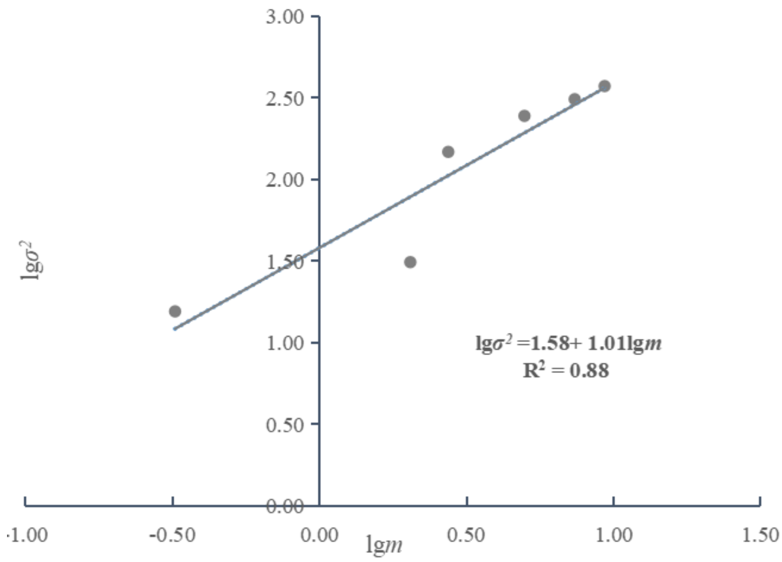

Figure 5. The linear regression between lg$m$ and lgσ^2 of *L. echidninus* based on Taylor's power function (lgσ^2 =1.58+1.01 lg$m$).

DISCUSSION

Laelaps echidninus is a globally distributed gamasid mite of medical importance. Southwest China, encompassing five provincial regions, represents a key area for the study of this species. In the present study, a total of 38,423 *L. echidninus* mites were recorded at 78 of 122 survey sites, with these positive sites spanning diverse geographical locations across the region (Fig. 1). Among 212 gamasid mite species (207,946 individuals) identified in southwest China, *L. echidninus* was the second most abundant species, representing 18.48% of the total (C_r = 18.48%; 38,423/207,946). The 29 host species of *L. echidninus* belonged to 15 genera, six families, and three orders. These results indicate that *L. echidninus* is widely distributed across southwest China, with a large population size and a broad host range.

Rodents (Rodentia) harbored the majority of mites (C_r = 99.65%, 38,290/38,423), with 71.00% (27,282/38,423) specifically associated with *Rattus* species within the family Muridae. Three *Rattus* species (*R. tanezumi*, *R. nitidus*, and *R. norvegicus*) accounted for 69.90% of all mites, with *R. nitidus* exhibiting the highest infestation indices (P_M = 67.35%, *MA* = 9.33 mites/rat, P < 0.001) (Table 2). Although *L. echidninus* parasitizes multiple host species, these findings indicate a degree of host preference, with rodents—particularly *Rattus* rats—serving as primary hosts in the region. This is consistent with previous observations that while many gamasid mites exhibit low host specificity, they often display selective host preferences (Yin *et al.* 2025). As important members of the rodent community, *Rattus* rats are of considerable medical relevance, acting as reservoir hosts for HFRS and other zoonoses (Dahmana *et al.* 2020). Many of these rats, including *R. tanezumi*, *R. norvegicus*, and *R. nitidus*, frequently occur in human dwellings and agricultural areas, creating close associations with human activity (Puckett *et al.* 2020). The high abundance of *L. echidninus* on these rodents underscores the potential risk of zoonotic pathogen transmission and the persistence of infection foci in southwest China.

Infestation indices also varied with host sex and age. Male hosts exhibited higher *MA* and *MI* than females, and 84.24% of mites were collected from adults, which had higher *MA* and *MI* compared to juveniles (*MI*: P < 0.05). These findings indicate sex- and age-related biases in host infestation. Such biases are common in both endoparasite and ectoparasite systems and are influenced by complex behavioral and physiological mechanisms (Zuk and McKean 1996; Guo *et al.* 2013). For instance, adult rats typically have larger body sizes and broader activity ranges for foraging and mating, increasing their exposure to ectoparasites (Lv *et al.* 2021). During the reproductive period, males may experience heightened intrasexual competition and immunosuppressive effects, which collectively increase susceptibility to parasitic infestations relative to females (Folstad and Karter 1992).

Environmental heterogeneity also influenced infestation, with P_M, *MA*, and *MI* varying across latitude, longitude, altitude, habitat, and landscape type (Peng *et al.* 2018b). Regarding the mites themselves, the population exhibited a strong female bias (C_r= 97.27%) and was dominated by adults (C_r = 96.73%), with juveniles representing only 3.27% of all mites. Similar patterns are observed in other gamasid mites, although the underlying mechanisms remain unclear. As a facultative ectoparasite, *L. echidninus* occurs both on host bodies and in host nests, and some juvenile stages, particularly larvae, do not feed on host blood and are therefore less frequently collected from hosts (Wharton and Radovsky 1967).

Taylor's power law analysis (lg*a* > 0, *b* > 1) indicated that *L. echidninus* exhibits an aggregated distribution among hosts (Table 8, Fig. 5). This pattern, consistent with other ectoparasites (Strong *et al.* 1997), suggests that while some hosts harbor few or no mites, others support high mite densities, occasionally forming swarms on their bodies. Aggregated distributions can facilitate intraspecific interactions, such as mating and competition, and enhance parasite survival, reproduction, and population persistence (Peng *et al.* 2016). Moreover, aggregation may function as a protective mechanism, promoting survival under environmental stress and predation pressure (Curley *et al.* 2015).

CONCLUSION

The gamasid mite *Laelaps echidninus*, a potential vector of zoonotic diseases such as hemorrhagic fever with renal syndrome (HFRS), is widely distributed in southwest China with a large population, primarily parasitizing rodents, especially *Rattus* species. Infestation dynamics are influenced by host sex and age biases, as well as environmental heterogeneity. The natural population is strongly dominated by adult females, and mites exhibit an aggregated distribution among host individuals. High densities of *L. echidninus* on rodents, particularly *Rattus* rats, may increase the risk of zoonotic pathogen transmission and contribute to the persistence of infection foci in the region.

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پراکندگی و آلودگی هرنای گاماسید *Laelaps echidninus* (Mesostigmata: Laelapidae) بر روی پستانداران کوچک در پنج منطقهٔ استانی جنوب غربی چین

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۱ مهر ۱۴۰۴

پذیرش

۹ دی ۱۴۰۴

انتشار

۲۶ فروردین ۱۴۰۵

دبیر تخصصی

ا. جوهرچی

چکیده

این مطالعه به بررسی الگوهای پراکندگی و آلودگی هرنای گاماسید *Laelaps echidninus* (Mesostigmata: Laelapidae) روی پستانداران کوچک در جنوب غربی چین می‌پردازد تا مبنای علمی برای نظارت بر بیماری‌های مشترک منتقله توسط هرنا را فراهم کند. شیوع (P_M)، میانگین فراوانی (MA) و میانگین انبوهی (MI) محاسبه شد و قانون توان تیلور برای توصیف الگوی توزیع مکانی به کار گرفته شد. در مجموع ۳۸۴۲۳ هرنای *L. echidninus* از ۴۳۵۱ پستاندار کوچک از ۲۹ گونه جمع‌آوری شد که ۹۹/۶۵٪ آنها از روی جوندگان یافت شدند. موش *Rattus nitidus* بیشترین P_M (۶۷/۳۵٪) و MA (۹/۳۳ هرنا در هر میزبان) را نشان داد ($P < 0.001$). میزبان‌های نر، و بالغ، به ترتیب شاخص‌های آلودگی، به ویژه MI، بسیار بیشتری نسبت به میزبان‌های ماده و نوجوان نشان دادند ($P < 0.05$). آلودگی به مقدار زیادی در بین محیطها متفاوت بود. ماده‌های بالغ، و بالغها به ترتیب به میزان زیادی از نرها و نوجوانان بیشتر بودند و جمعیت هرنا توزیع تجمعی در بین میزبان‌ها نشان داد. هرنای *L. echidninus* به طور گسترده در جنوب غربی چین پراکنده است و جوندگان میزبان اصلی آن هستند؛ سوگیری‌های مربوط به جنسیت و سن میزبان، همراه با ناهمگونی محیطی، به شدت بر پویایی آلودگی تأثیر می‌گذارند، به طوری که ماده‌های بالغ در جمعیت هرنا غالب هستند.

واژگان کلیدی: کنه‌ها، هرنای گاماسید، *Laelaps echidninus*، انگل بیرونی، پستاندار کوچک، جنوب غربی چین

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