

What's Eating You? Tropical Rat Mite (*Ornithonyssus bacoti*)

Rame Yousif, MD; Madison Anzelc, MD; Brandon Zakeri, MD; Nancy Parquet, MD

PRACTICE POINTS

- The tropical rat mite (*Ornithonyssus bacoti*) can infest humans who make bodily contact with a rodent, reside in living spaces infested with rodents, or own any pets.
- Patients infested with rat mites may present with pruritic, erythematous, cutaneous lesions with secondary excoriations that can be mistaken for an infection or dermatitis.
- The recommended treatment of rat mite infestation includes antiparasitic medications such as permethrin or pyriproxyfen. Preventive measures include proper disinfection of living spaces.

The tropical rat mite (*Ornithonyssus bacoti*) commonly infests wild and pet rodents, but they are not host specific. Bodily contact with wild or domesticated rodents is the most common source of infestation. Mites can live off many mammal hosts for a long period of time; therefore, living in quarters infested by mice can lead to mite exposure. Human infestation presents as urticarial, pruritic, cutaneous lesions that may be misdiagnosed as an arthropod bite, an infection, or contact dermatitis. Symptomatic relief of pruritus can be provided with a topical corticosteroid or antihistamine. The most effective treatment is an antiparasitic, such as permethrin cream, as well as extermination of rodents, mites, and any other pests in the patient's living space.

Cutis. 2023;112:132-134.

The tropical rat mite (*Ornithonyssus bacoti*) belongs to the family Macronyssidae. These mites are commonly mistaken for red bird mites or Nordic bird mites because they belong to the same family and have similar characteristics.¹ Although *O bacoti* is called the tropical rat mite, it also can be found in moderate climates.^{2,3}

Characteristics

The life cycle of a tropical rat mite lasts 11 to 13 days and includes 5 stages: egg, larva, protonymph, deutonymph, and adult.^{1,2} The length of the mite (0.3–0.7 mm) varies with the stage of development.¹ Adults can reach 0.75 to 1.40 mm, with females larger than males and possibly visible with the naked eye.^{1,2}

Two or 3 days after a blood meal, the female mite lays approximately 100 eggs in its nest but not on the surface of a host. The eggs hatch into larvae after 1 to 4 days and go on to complete their life cycle.¹ During developmental stages, mites occupy their hosts for blood meals. Mites search for their hosts at night and prefer wild or pet rodents for blood meals but are not host specific and can be found on many mammals including birds, cats, racoons, and squirrels.⁴

Although tropical rat mites prefer rodent hosts, they can infest humans when their preferred host is unavailable. In the United States, the first case of human dermatitis due to a tropical rat mite occurred in 1923. In Europe, rat mite dermatitis was first reported in a human in 1931, possibly due to contamination of sailing vessels.⁴

Infestation and Transmission

Tropical rat mites prefer wild and pet rodents as hosts because the mites are able to feed on their blood over long periods.⁴ During the day, the mite spends most of its time hiding in dark dry spaces; it is most active during the night, traveling to find a host for meals.³⁻⁵ If a preferred host is not present, the mite may choose to infest a human.⁵

Human infestation occurs most often upon close bodily contact with an infected animal or pet rodent that was sold without parasites having been eliminated.³⁻⁵ Mites are able to survive without a host for as long as

From the Department of Dermatology, University of Toledo College of Medicine, Ohio.

The authors report no conflict of interest.

Correspondence: Rame Yousif, MD, 3125 Transverse Dr, Room 0012, Toledo, OH 43614 (rameyousif1@gmail.com).

doi:10.12788/cutis.0849

6 months; they may travel after a meal.^{1,2} Therefore, individuals who do not have a pet rodent can be infested if an infected wild rodent has infested their living space.^{1,3-5}

Clinical Presentation of Infestation

Patients infested with tropical rat mites present with pruritic cutaneous lesions, most often on unclothed parts of the body that are easily exposed to mites; lesions rarely occur on the scalp.⁵ People of any age or gender can be infested. Rat mite bites can present as single or grouped, pruritic, erythematous papules ranging in size from 4 to 10 mm in diameter.⁵⁻⁷ Excoriations may be present due to excessive scratching. Although rare, vesicles or nodules have been reported.^{5,7}

Diagnosis of the underlying cause of the cutaneous manifestations often is difficult because mites are not visible during the day, as they are less active then.² Lesions often are misdiagnosed as an allergic response, a bacterial infection, or various forms of dermatitis.¹ A parasitic cause often is not considered unless the physician or patient detects a mite or many trials of therapies fail to provide relief.^{1,3-5} Eliciting a thorough history may disclose that the patient has had close contact with rodents or lives in a community center, shelter, or shared space. If any of the patient's close contacts have a similar presentation, infestation with mites should be considered.

Treatment and Prevention

Patients should be educated about treatment options and measures that need to be taken to prevent reinfestation. It has been reported that tropical rat mites can survive without a blood meal for as long as 6 months; therefore, meticulous inspection and decontamination of all living spaces is required.^{1,4} Once identified, physicians may prescribe an antiparasitic such as permethrin or pyriproxyfen to prevent further infestation and eliminate mites on the host.⁵ Lindane and benzyl benzoate previously were reported to be effective but should be prescribed only in correctly diagnosed cases due to the potential adverse effects of both therapies.^{4,7-10} For effective treatment, physicians should thoroughly review the proper application of topical treatments with patients. Topical creams should be massaged into the skin from the head to the soles of the feet, covering all creases of the skin and between the fingers and toes. Antiparasitic creams should be left on the skin for 8 to 14 hours, and all members of the household should be examined and treated, if necessary, by a physician. A thorough bath removes tropical rat mites, but preventive measures should be taken to prevent reinfestation.⁴ Antihistamines or glucocorticoids also can be used as symptomatic treatment.^{6,8}

Avoiding Reinfestation—Preventive measures should be taken to prevent reinfestation, including evaluation by an exterminator for any wild rodents to remove nests and treat the living space with an acaricide.⁵ Insecticides administered by exterminators, including malathion, methyl carbamate, and lindane, also have been reported

to be effective for preventing reinfestation.^{5,7-9} A veterinarian should be consulted if the patient owns any pets to ensure proper identification of any potential tropical rat mites and treatments that may be necessary for any household pets.¹

Case Report

A 68-year-old man presented to the dermatology outpatient clinic with diffuse pruritus of the skin and scalp. He reported no other symptoms and had never had a total-body skin examination. His primary care physician recently prescribed a dose pack of methylprednisolone 4-mg tablets, which relieved the symptoms except for a mild scalp itch. His wife did not experience itching, and he denied noticing mites or fleas on his pet dog. Physical examination did not reveal any contributory findings, such as erythema or rash. Ketoconazole shampoo 2% and fluocinolone solution 0.01% were prescribed for scalp pruritus; however, he could not afford those medications and therefore did not take them.

Two weeks later, the patient presented with diffuse itching that involved the scalp, trunk, and extremities. He denied groin pruritus. He reported that the itching was worse at night. His wife continued to be asymptomatic. The patient reported that his health screening was up-to-date, and he had no interval health changes. A complete blood cell count, thyroid studies, and a comprehensive metabolic panel performed recently were within reference range. He denied recent travel or taking new medications. Physical examination revealed a somewhat linear distribution of erythematous urticarial papules on the right side of the abdomen. Red dermatographic excoriations were noted on the back. No burrows were visualized. He was given intramuscular triamcinolone 60 mg and was advised to have his house evaluated for bed bugs and his pet dog evaluated by a veterinarian for mites. During the triamcinolone injection, the medical assistant observed a 1- to 2-mm red insect, which fell into his clothing and could not be further evaluated.

After 1 month, the patient had no improvement of the pruritus; instead, it became worse. During this time, his wife developed intermittent urticarial-like eruptions. He was taking oral diphenhydramine nightly and applying triamcinolone cream 0.5% that he had at home from an earlier skin problem as needed. Physical examination findings correlated with worsening symptoms. He had multiple erythematous urticarial papules—many of which were excoriated—across the chest, abdomen, buttocks, and back. The arms had multiple excoriations. The urticarial papules coalesced in the anterior axillary folds, yet no burrows were visualized. In the left anterior axillary fold adjacent to one of the urticarial papules, a 1-mm mobile mite was identified on dermoscopy. Further evaluation by microscopy showed morphologic characteristics of a tropical rat mite (Figure). The patient admitted that his house had a mouse infestation that he was struggling to eliminate. Permethrin cream 5% was prescribed.



Tropical rat mite (*Ornithonyssus bacoti*) under microscopy.

Because the patient could not afford the prescription, he was advised to use the triamcinolone cream 0.5% and oral diphenhydramine that he had at home nightly for symptomatic relief. He was advised to hire an exterminator to eradicate the mouse and mite infestation to prevent reinfestation.

Identification of Rate Mite Dermatitis

The characteristics of tropical rat mite dermatitis can be confused with many other conditions, such as infection. Even when a mite is identified, it can be difficult to classify it as a tropical rat mite. To confirm the diagnosis of tropical rat mite dermatitis, the parasite needs to be identified. Skin scrapings can be collected from pruritic lesions and examined microscopically in the hope of revealing the rat mites. The recommendation is to collect skin scrapings from the dorsal aspect of the hands or from the neck.⁵ Patients may report finding mites in their living space or on their bedding or clothing.

Although the tropical rat mite was reported as a vector for endemic typhus between humans, no other cases of transmission between humans have been reported since.^{11,12} Studies reporting non-human subject research and case reports have shown that *O bacoti* is a vector for *Rickettsia akari*, *Coxiella burnetii*, *Francisella tularensis*, *Yersinia pestis*, Eastern equine encephalitis virus (Alphavirus), Enterovirus (Picornaviridae), Langat virus (Flavivirus), and Hantaan orthohantavirus.^{5,11-17} However,

no cases of these infectious diseases being transmitted naturally have been reported.⁵

Confirmation of *O bacoti* as a vector for human pathogens is difficult because it relies on identification of the mite in the clinic.⁵ The epidemiologic importance of the mite in transmitting infectious disease is unknown; reports of human cases of mite infestation are rare. We present this information to increase awareness and help dermatologists and other health care providers identify *O bacoti*.

REFERENCES

1. Beck W, Fölster-Holst R. Tropical rat mites (*Ornithonyssus bacoti*)—serious ectoparasites. *J Dtsch Dermatol Ges*. 2009;7:667-670. doi:10.1111/j.1610-0387.2009.07140.x
2. Baumstark J, Beck W, Hofmann H. Outbreak of tropical rat mite (*Ornithonyssus bacoti*) dermatitis in a home for disabled persons. *Dermatology*. 2007;215:66-68. doi:10.1159/000102037
3. Beck W. Occurrence of a house-infesting tropical rat mite (*Ornithonyssus bacoti*) on murides and human beings. *Travel Med Infect Dis*. 2008;6:245-249. doi:10.1016/j.tmaid.2008.01.002
4. Beck W. Tropical rat mites as newly emerging disease pathogens in rodents and man. *Trav Med Infect Dis*. 2007;5:403. doi:10.1016/j.tmaid.2007.09.016
5. Engel PM, Welzel J, Maass M, et al. Tropical rat mite dermatitis: case report and review. *Clin Infect Dis*. 1998;27:1465-1469. doi:10.1086/515016
6. Hetherington GW, Holder WR, Smith EB. Rat mite dermatitis. *JAMA*. 1971;215:1499-1500.
7. Fox JG. Outbreak of tropical rat mite dermatitis in laboratory personnel. *Arch Dermatol*. 1982;118:676-678. doi:10.1001/archderm.1982.01650210056019
8. Fishman HC. Rat mite dermatitis. *Cutis*. 1988;42:414-416.
9. Ram SM, Satija KC, Kaushik RK. *Ornithonyssus bacoti* infestation in laboratory personnel and veterinary students. *Int J Zoonoses*. 1986;13:138-140.
10. Brown S, Becher J, Brady W. Treatment of ectoparasitic infections: review of the English-language literature, 1982-1992. *Clin Infect Dis*. 1995;20(suppl 1):S104-S109. doi:10.1093/clinids/20.supplement_1.s104
11. Reeves WK, Loftis AD, Szumlas DE, et al. Rickettsial pathogens in the tropical rat mite *Ornithonyssus bacoti* (Acari: Macronyssidae) from Egyptian rats (*Rattus* spp.). *Exp Appl Acarol*. 2007;41:101-107. doi:10.1007/s10493-006-9040-3
12. Philip CB, Hughes LE. The tropical rat mite; *Liponyssus bacoti*, as an experimental vector of rickettsialpox. *Am J Trop Med Hyg*. 1948;28:697-705. doi:10.4269/ajtmh.1948.s1-28.697
13. Zemskaja AA, Pchelkina AA. Experimental infection of ticks *Dermatonyssus gallinae* Redi *Bdellonyssus bacoti* Hirst with Q fever. *Dokl Akad Nauk SSSR*. 1955;101:391-392.
14. Hopla CE. Experimental transmission of tularemia by the tropical rat mite. *Am J Trop Med Hyg*. 1951;31:768-783. doi:10.4269/ajtmh.1951.s1-31.768
15. Clark GM, Lutz AE, Fadnessl. Observations on the ability of *Haemogamasus liponyssoides* Ewing and *Ornithonyssus bacoti* (Hirst) (Acarina, Gamasina) to retain eastern equine encephalitis virus: preliminary report. *Am J Trop Med Hyg*. 1966;15:107-112. doi:10.4269/ajtmh.1966.15.107
16. Schwab M, Allen R, Sulkin SE. The tropical rat mite (*Liponyssus bacoti*) as an experimental vector of Coxsackie virus. *Am J Trop Med Hyg*. 1952;1:982-986. doi:10.4269/ajtmh.1952.1.982
17. Durden LA, Turell MJ. Inefficient mechanical transmission of Langat (tick-borne encephalitis virus complex) virus by blood-feeding mites (Acari) to laboratory mice. *J Med Entomol*. 1993;30:639-641. doi:10.1093/jmedent/30.3.639