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Tropical rat mites (*Ornithonyssus bacoti*) – serious ectoparasites

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Summary
In Germany there is limited information available about the distribution of the tropical rat mite (*Ornithonyssus bacoti*) in rodents. A few case reports show that this hematophagous mite species may also cause dermatitis in man. Having close body contact to small rodents is an important question for patients with pruritic dermatoses. The definitive diagnosis of this ectoparasitosis requires the detection of the parasite, which is more likely to be found in the environment of its host (in the cages, in the litter or in corners or cracks of the living area) than on the hosts' skin itself. A case of infestation with tropical rat mites in a family is reported here. Three mice that had been removed from the home two months before were the reservoir. The mites were detected in a room where the cage with the mice had been placed months ago. Treatment requires the eradication of the parasites on its hosts (by a veterinarian) and in the environment (by an exterminator) with adequate acaricides such as permethrin.

Introduction
The tropical rat mite (*Ornithonyssus bacoti*) (Figure 1), whose developmental stages feed on the blood of their hosts, belong to the family Macronyssidae. They are frequently confused with red bird mites (*Dermanyssus gallinae*) or the Nordic bird mites (*Ornithonyssus sylviarum*), which also belong to the Macronyssidae and possess similar morphologic characteristics. An exact differential diagnosis is essential especially in view of possible epizoonoses, as only so can the origin or reservoir of the parasites be determined. Certain morphologic structures (e. g. hairiness, caudally pointed scutum [dorsal plate], typical form of the anal plate with a cranial anus) allow for differentiation of the tropical rat mite from other mite species (*O. bacoti:* very hairy, *D. gallinae* and *O. syviarum:*few hairs; *O. bacoti:* caudally pointed dorsal plate, *D. gallinae*: caudally rounded dorsal plate, O. *sylviarum:* dorsal plate with a conical end; *O. bacoti:* anal plate with cranial anus, *D. gallinae* and *O. syviarum:* anal plate with caudal anus). A specialist for medical arachno-entomology should be consulted. The fully engorged female *Ornithonyssus bacoti* can easily be seen with the naked eye on its host or in the litter or in hiding places (adult mites: 0.6-1.1 mm). The developmental stages, i. e. eggs, larvae and nymphs can usually be recognized with the help of adhesive tape stripping under the microscope (eggs: 0.3-0.4 mm, larvae 0.3-0.4 mm, nymphs: 0.5-0.7 mm). Females, who live up to 70 days, lay 90-120 eggs 2-3 days after a single blood meal in various nests in the environment, not on the skin surface of the host. After another 1-4 days larvae hatch form the eggs. The entire developmental cycle lasts 11-16 days at normal room temperature and at a relative humidity of 75-80 %.

Just as most representatives of the Macronyssidae tropical rat mites are active at night and seek dark hiding places during the daytime. At night the parasites search for their preferential hosts (especially wild rodents [Norway rat, house rat and mouse] and pet rodents that are offered for sale in pet stores [gerbil and hamster] to feed on blood. If suitable preferential hosts are unavailable

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Figure 1: Tropical rat mite (*Ornithonyssus bacoti*), Note: sharp caudal apex of the scutum and hairy body surface (200 ×).

Figure 2: Close skin contact to small mammals, e. g. rats, facilitates transmission of skin parasites, e. g. tropical rat mites.

or in the case of close human-animal skin contact, the mites can occasionally infest humans. The sale and distribution of small rodents without elimination of ectoparasites as well as litter and feed from breeding and sales cages contribute considerably to the spread of these parasites [1]. Further, free-roaming cats that catch affected rodents also contribute to the spread of these parasites to pet owners.

As infestation with tropical rat mites often occurs with very close bodily contact between human and affected animal, children with pets are particularly exposed (Figure 2) [1, 2]. Sometimes even people who have no pets in their home and no other contact with animals are also infested. In such cases wild rodents can serve as a reservoir for the mites. As the mites have a large radius of action, they are entirely capable after a blood meal to leave their preferential hosts and enter buildings and living quarters [3-6]. People visited upon by the tropical rat mite develop pruritic insect bite-like cutaneous lesions. At the visit of the physician the patient is usually unaware of the cause. As the parasites are active at night and the blood meal on the skin of the host lasts maximally 20 minutes, they usually cannot be detected on the skin [4, 5]. The primarily consulted physician will therefore usually consider cutaneous lesions to be a result of allergies, fungal infections or bacterial infections. Suspicion of a parasitic cause only dawns after unsuccessful symptomatic therapies or after finding mites in the living or working environment. Research on the etiology usually is restricted to an inquiry of the patient; on-site inspection as well as examination of living quarters are rarely performed. Recently infestations with tropical rat mites have increasingly been observed in Germany and other European nations [1]. Adequate control measures demand an exact parasitological species determination to clarify the etiology and detect the mite reservoir. *Ornithonyssus bacoti* affects primarily wild rodents such as rats and mice in Germany. In private households even well-cared for small mammals are possible reservoirs [7]. In the 11 registered cases of human infestation with tropical rat mites in Germany, all could be attributed to the appearance of parasite in the living quarters [8]. Due to the difficult diagnosis of this pathogen and the suspected number of unrecognized infestations, a much greater distribution of this mite species than assumed to date is probable. An affected family will now be presented.

Case report

A married couple and their adult daughter present in the outpatient service of the Department of Dermatology, Kiel, because of pruritic cutaneous lesions. These have been present for weeks and various topical agents including glucocorticosteroids have hardly led to improvement. Dermatologic examination shows excoriated papules and urticae,

Figure 3: Cutaneous lesions of the mother. Multiple excoriated papules, partly urticarial, on the upper extremity.

clinically similar to an ictus (arthropod bite) reaction. While the father and daughter had only few lesions on the forehead and dorsa of hands, respectively, the mother displayed multiple acute and chronic lesions especially on the limbs (Figure 3). To exclude prurigo simplex subacuta or a pruriginous dermatitis, skin biopsy was performed confirming the clinical diagnosis of ictus reaction. Animal contact, especially pets, was denied. The family, who only recently had moved into a new building, was instructed to carefully inspect their

Figure 4: Dust lice (*Psocoptera*), a common arthropod in flats with high humidity and mildew, e. g. behind wallpaper (600 ×).

living quarters for possible parasites and to reconsider their history of animal contact. Several days later we received a small package with insects which were microscopically identified as book or dust lice (*Psocoptera*) (Figure 4). These insects that often occur in new buildings play a medical role, as type 1 allergies eliciting rhinitis and asthma, but can be excluded as the cause of the cutaneous lesions. During a telephone call two weeks later the mother continued to complain of highly pruritic cutaneous lesions. She also reported on mice that the daughter had held in her room up to three months previously. As symptoms persisted even without the mice, she had not considered this information important. We recommended to examine the room and especially the exact place where the cage with the mice had stood for the presence of parasites. The content of the next package brought the solution: *Ornithonyssus bacoti*. After adequate extermination with permethrin sprays, symptoms did not recur.

Discussion

In the USA the tropical rat mite was first described as he nosogenic agent of a human dermatitis in 1923. In Germany *Ornithonyssus bacoti* was first discovered on infested ship rats in the port of Hamburg in 1931 and may possibly have spread from here to new areas of distribution [9]. As the pathogen is cosmopolitic and is found in tropical as well as moderate climate zones the name tropical rat mite is misleading for the uninitiated and may suggest that this skin parasite does not even occur in Middle Europe. According to our own observations about 80 % of wild rodents in Germany are infested by this parasite [4, 5]. If the tropical rat mite plays a role as vector for various diseases is unknown. In the literature infestations of rodents and humans, too, with *Ornithonyssus bacoti* manifesting clinically as ictus reactions have been reported [1-16]. As it is a parasite active at night, predominantly skin regions not covered by tight clothing are affected. When primary hosts are lacking, for example after elimination of rats or in cases of heavy infestation of small pets, the parasites can expand their radius of activity and temporarily infest humans. Exactly this was observed in a medical student in Munich, Germany [4, 5] who kept no pets and had attacks of pruritus predominantly in the night. A search for parasites was successful. After the veterinarian identified the tropical rat mite an on-site inspection and inquiry of other tenants were performed. Not only in the apartment of the student but in the apartment of other tenants who also had pruritic cutaneous lesions, a mass infestation with *Ornythonyssus bacoti* was found. An exact evaluation revealed that cutaneous lesions appeared in temporal association with extermination of rodents in the back yard of the house. From here masses of mites, due to the lack of the main hosts, obviously found their way along vertical conduit pipes in their search for new mammals ("blood donors") into the apartments of the tenants. The mite plague was eliminated by an extermination with the use of permethrin.

Another route of transmission is by pets. As these are usually kept in adequate hygienic conditions, a massive infestation by tropical rat mites is an exception. When suspected, it is always advisable to have a veterinarian carefully examine animals, cages and litter. In a family of five who kept two gerbils and a hamster massive numbers of tropical rat mites were discovered in the litter of the gerbils [2]. While the hamster and the parents showed no signs or symptoms, all children (wheals, excoriated papules) and both gerbils (uneasy, superficial excoriations on the head, ears and neck) were affected. Parasite control on the animals and in the environment was able to completely eliminate the invading mite population.

In recent years among the mites sent in for diagnostics from human living quarters in Berlin and the state of Brandenburg in 15 cases mites of the genus *Ornithonyssus* were identified, of these in seven cases the tropical rat mite *Ornithonyssus bacoti*, in four cases the Nordic bird mite *Ornthonyssus sylviarum*, in four further case species identification was not possible [8].

For elimination various acaricides in spray form can be employed. Well-suited are most "flea sprays" containing permethrin and piriproxyfen [17, 18]. The parasites can survive for a time without a live host without a blood meal. Details on the exact time are lacking. In the case presented here *Ornithonyssus bacoti* survived for weeks in the conduit pipes after rodent elimination in the back yard before people in the second floor were infested. According to our own observations tropical rat mites can survive up to 6 months without a blood meal [1].

Increasingly, especially if small rodents are held as pets, infestation with animal ectoparasites, especially tropical rat mites, should be considered in the differential diagnosis. To verify the parasitosis possibly infested animals should be examined by a veterinarian to identify and eliminate skin parasites. Even with a negative history of animal contact, the careful inspection of the living quarters for parasites is prudent, as the described case demonstrates. <<<

Conflicts of interest
None.

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Query/Note to the author: Der foglende Satz wurde leicht verändert: alt: Three mice when had be removed from the home two months before were the reservoir. Neu: Three mice that had been removed from the home two months before were the reservoir. Bitte prüfen.
Note to the author by translator: Ich habe kleinere Änderungen in den Abbildungslegenden vorgenommen.