Two Cases of Tinea Corporis by Infection from a Rabbit with *Arthroderma benhamiae*

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(Received: 25, January 2000. Accepted: 10, May 2000)

**Abstract**

The first cases of tinea corporis with *Arthroderma benhamiae* in Japan are reported. A 7-year-old girl and a 30-year-old mother in Shimane prefecture suffered from dermatophyte infections on the neck, shoulder, arms and leg. Three isolates from the two patients and a rabbit by which they supposedly were infected, were identified as *Trichophyton mentagrophytes*. On the bases of mating tests using the tester strains of both the African race and the Americano-European race of A. benhamiae, they were identified as *A. benhamiae* African race mating type (−). Our results are the first to indicate that both races of *A. benhamiae* exist in Japan.

**Key words**: African race, *Arthroderma benhamiae*, mating, tinea corporis, *Trichophyton mentagrophytes*.

**Introduction**

In recent years cases of dermatophytosis transmitted from animals to humans have been increasing due to environmental changes of humans and animals1), increases in the variety of pets and increases in the trend of keeping pets indoors rather than outdoors.

*Trichophyton mentagrophytes*, like *T. verrucosum* and *Microsporum canis*, is a zoophilic dermatophyte which causes tinea in humans. *T. mentagrophytes* has three sexual states, *A. benhamiae*, *A. vanbreuseghemii* and *A. simii*2).

*T. mentagrophytes* in Japan is known to be mainly *A. vanbreuseghemii*3), and only *A. benhamiae*4) has been isolated from a rabbit.

Herein, we report the isolation of *A. benhamiae* not only from a rabbit but also from human patients in Japan.

**Case 1**

In October, 1996, a 7-year-old girl in Yatsugun, Shimane-pref., noticed erythematous lesions with scales on her forearms and neck. Three days later, she visited the dermatology clinic at Tottori University Hospital. An approximately 35×40 mm circular lesion on the left side of the neck was sharply marginated erythema with scales (Fig. 1). A lesion on the right wrist, 25 mm in diameter, and another at the center of the left forearm, 15 mm in diameter, were similar to the lesion on the neck. KOH examinations of scales were positive for fungi. The lesions were successfully treated with topical Lanoconazole.

**Case 2**

The mother of case 1, a 30-year-old, noticed two itchy lesions. An approximately 35×45 mm annular, itchy lesion on the front side of the left shoulder was desquamating erythema with impetiginous erosion. A lesion on the anterior site of the right lower leg was a plaque of...
multiple miliary red-papules. KOH examinations of scales were positive for fungi. Lesions were topically treated with Lanoconazole without success, after which Butenafine hydrochloride cream proved successful.

The family and life style

The patients' family, 2 grandparents, 2 parents, an aunt and 2 children (Fig. 2), live together. They received two 2-month-old crossbreed rabbits from a friend in early September 1996, and kept them in a rabbit cage in the living room. The family used to hold and stroke the rabbits. They noticed alopecia on the left foot of one of the rabbits (Fig. 3), and separated them into different cages. The alopecia improved spontaneously.

Within a month after receiving the rabbits, 4 members of the family, including cases 1 and 2, successively noticed lesions on their skin. First, the grandfather noticed one lesion on his back. Next, the grandmother found a similar lesion on her lower left leg. The mother then found a lesion on her lower left leg. The mother then found a lesion on her left leg and on each arm (case 1).

The grandfather’s lesion was diagnosed as dermatophytosis by a dermatologist who prescribed a topical antifungal treatment. The grandmother treated her skin lesion with the same antifungal. Their lesions subsequently disappeared. No member had tinea pedis.

Mycological findings

Dermatophytes were isolated from skin scrapings of the neck of case 1, the lower leg of case 2 and the foot of the rabbit. All isolates were macroscopically similar (Fig. 4), grew rapidly at 27°C without nutritional requirement and produced white and fluffy colonies with a slightly powdery margin and an orange-yellow reverse side on Sabouraud’s dextrose agar. Abundant spiral bodies and globose microconidia were observed microscopically (Fig. 5). The three isolates were identified as *Trichophyton mentagrophytes* on the basis of the clinical, macroscopical and microscopic findings.

To identify the *Arthroderma* states of the isolates, mating tests were performed using 8 tester strains of 3 *Arthroderma* species (Table 1). Three isolates were paired with (+) and (−) strains of each species on a medium of “1/10 Sabouraud + salts”2). All three of the isolates produced numerous gymnothecia only when paired with an African race (+) strain of *A. benhamiae* (Fig. 6). In the second mating test, fewer gymnothecia were produced (Fig. 7).

Ascospores were observed with a scanning electron microscope3): A gymnothecium was
picked up from the plate of Fig. 8, fixed in 2% glutaraldehyde and then in 2% osmium tetroxide, dried at a critical point, platinum-sputtered, and observed with a scanning electron microscope (JSM-840, JEOL Japan).

Characteristics of genus *Arthroderma*, echinulate dumbbell-shaped peridial hyphae with smooth walled spiral ends were observed (Fig. 8). Abundant matured lenticular ascospores were also seen.

On the basis of the mating behavior with

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**Discussion**

In 1967, Ajello & Cheng described *A. benhamiae* as the teleomorph of *T. mentagrophytes*. *A. benhamiae*, as well as *A. vanbreuseghemii*, is common in America, Africa and Europe.

According to Takashio, on the basis of the mating test, strains of *T. mentagrophytes* can be divided into *A. simii*, *A. benhamiae*, *A. vanbreuseghemii* and a group whose perfect state is...
unknown but is known to include mainly T. interdigitale. There are two races of A. benhamiae, African and Americano-European. A pair from the same race are sexually very compatible with each other and produce many gymnothecia, but a pair from the different races are weakly or poorly compatible.

Hejtmanek M & Hejtmankova N\(^7\) performed mating tests on 132 strains of T. mentagrophytes including 121 clinical isolates in Czechoslovakia in 1989. Forty-one of the 132 strains mated with A. benhamiae, 10 mated with A. vanbreuseghemii and the remaining 81 did not mate with any tester strains. Seventy-one of these 81 strains were sexually stimulated with one or more tester strains. Of 60 strains stimulated with A. benhamiae, twelve were stimulated with A. benhamiae alone. In their study, only the A. benhamiae Americano-European race was used as tester, not the African race. These results\(^7\) suggested that A. benhamiae was predominant in Czechoslovakia.

The existence of another mating group (African race) of A. benhamiae was suspected because some strains were stimulated with, but not mated with, the Americano-European race of A. benhamiae. Actually, Takashio\(^7\) classified one Belgian strain and one Portuguese strain as the African race,
indicating that both races exist in Europe.

On the other hand, according to Hironaga & Watanabe, the population of strains in Japan is different from that in Europe. They performed mating tests on 334 Japanese *T. mentagrophytes* in 1980 and showed that 41 strains mated with *A. vanbreuseghemii* (+), 8 mated with *A. vanbreuseghemii* (−) and none mated with *A. benhamiae* or *A. simii*. The tester strains they used for mating with *A. benhamiae* were only of the Americano-European race (RV26678 and RV26680) and not of the African race. Of 334 *T. mentagrophytes* strains, 279 were *T. interdigitale* (*T. mentagrophytes* var. *interdigitale*). The remaining 55 strains of *T. mentagrophytes* sensu stricto (*T. mentagrophytes* var. *mentagrophytes*) comprised 49 *A. vanbreuseghemii* and 6 incompatible strains.

From these results, Watanabe suggested that *A. benhamiae* was not present in Japan. Hasegawa thought that *A. vanbreuseghemii* was the only teleomorph of *T. mentagrophytes* in Japan. Actually, no isolation of *A. benhamiae* or *A. simii* had been reported until 1998.

In 1998, Kano et al. reported that an isolate of *T. mentagrophytes* from a 2-month-old rabbit at a veterinary clinic in Hyogo pref. was identified as *A. benhamiae* by polymerase chain reaction analysis using species-specific primers, and successfully mated with a tester strain of Americano-European race (+) of *A. benhamiae*.

Therefore our cases are the second isolation of *A. benhamiae* from a rabbit, and the first cases of tinea corporis caused by *A. benhamiae* in Japan. From the results of Kano and our mating tests with African race (+) (RV30000), both races of *A. benhamiae* exist in Japan.

For over twenty years since the technique of the mating test became available, *A. benhamiae* had not been isolated in Japan. However, both races of this species have been found very recently. This may be because either 1) imported pets have recently brought it into Japan, as a hedgehog carried *T. mentagrophytes* var. *erinacei* into New Zealand, or 2) the African race of *A. benhamiae* existed in Japan without being detected by mating with tester strains of Americano-European race. Because the strains of the African race were not used in the study of Hironaga & Watanabe, existence of the African race in Japan at that time remained unknown. Therefore we recommend using tester strains of both races.

As 4 in a family of 7 were infected with *A. benhamiae* from a rabbit within a month, the infectivity of *A. benhamiae* may be similar to *A. vanbreuseghemii*.

Finally, the mating tests of *T. mentagrophytes* isolates from animals and humans using both races of *A. benhamiae* are important for better understanding of *A. benhamiae* distribution.

References