

【原著論文】

The possibility of skin disorders caused by *Balaustium murorum* (Acarina: Erythraeidae) in short term contacts

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カベアナタカラダニの短期接触による皮膚障害発生の可能性

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Abstract

The erythraeid mite *Balaustium murorum* (Hermann) is a nuisance in urban areas of Japan. Some residents worry about mite-induced harm, especially regarding bites. To determine whether *B. murorum* causes skin disorders, mites were kept in contact with human skin for 6 or 24 hours, and the skin condition was observed. Living mites did not cause itching in these experiments. It appeared that the mites seldom bit human skin and caused dermatitis; however, one volunteer had a red skin rash after 24-hour contact with crushed mites. The mites' body fluids seemed to cause the skin disorders. Care should be taken to avoid crushing mites and to prevent their body fluids from coming in contact with skin.

摘要

カベアナタカラダニ (*Balaustium murorum*) はわが国の都市部における不快害虫である。住民はこのダニの害、特に刺されることを心配している。このダニが人を刺して痒みや皮疹を起こすのか明らかにするため、人の皮膚に6ないし24時間接触させ、その後の皮膚の状態を観察した。生きているダニは痒みを起こさず、刺したり皮疹を生じさせたりすることはほとんどないと考えられた。しかし、潰したダニを24時間接触した被験者に赤い皮疹が生じた。ダニの体液が皮膚障害を発生させたと思われる。ダニを潰してその体液を皮膚に付けないよう注意する必要がある。

Key words: erythraeid mite (タカラダニ), *Balaustium murorum* (カベアナタカラダニ), human skin (肌), skin disorder (皮膚障害), itchiness (痒み), dermatitis (皮膚炎)

INTRODUCTION

Balaustium murorum (Hermann) is a small red mite, 0.3–1 mm in length, whose mass emergence in the urban areas of Japan is creating a nuisance. Many mites wander on building walls and roofs in early summer, invading rooms and staining clothes with their body fluids. The wandering of the mites is considered as searching behavior toward their foods, i.e. pollen and small insects, on the ground (Takakura and Kohzu, 2008). Some residents are worried about the harm mites can cause, especially through their bites.

The possibility of *B. murorum* causing itchiness and dermatitis has been discussed for many years. One *Balaustium* species was reported to bite human skin in North America (Newell, 1963), the mouth part of which had a sword-like stylet that it used to pierce its prey (Yoder et al., 2006). Ido et al. (2003; 2004) reported intense *B. murorum* induced itching and dermatitis in a hospital. Hashimoto et al. (1998) and Shiba (2009) suggested that *B. murorum* accidentally bites human skin. On the other hand, Tongu (1995) reported that mite bites were not observed during the mass emergence of this species. The authors are not aware of any complaints of mite-induced itchiness by the residents of Tokyo. To

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determine whether *B. murorum* causes skin disorders, we placed the mites in contact with human skin and observed the subsequent skin condition.

MATERIALS AND METHODS

1. Sampling *B. murorum*

B. murorum were collected in field around buildings of our institute, Shinjuku ward, Tokyo in 2009 and 2010, where no male mites had been found (Ohno et al., 2009). The mites were picked up from the ground using a small writing brush and kept in Petri dishes on each test day. Their stages (larva, nymph and adult) were preliminarily evaluated under a stereoscopic microscope. Active mites were selected and used in the tests.

2. Test 1

2-1. Mite cage

We used a shell button as a mite cage because of its lack of static electricity and its softness against the skin, according to Yoshikawa (1985;

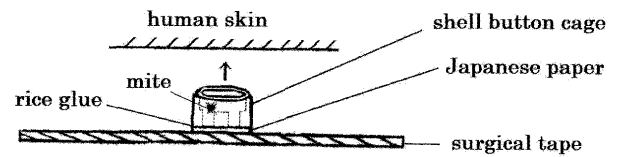
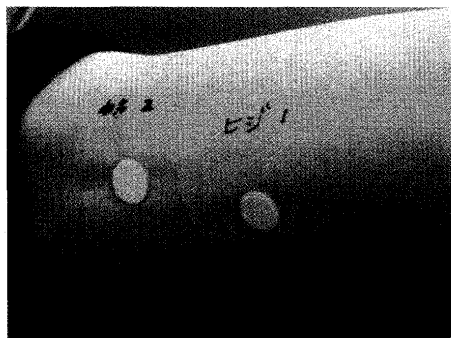


Fig.1. Button cage used for enclosing test mites.

1987) who used the button in an experimental dermatitis caused by cheyletid mites. A flat shell button (18–20 mm in diameter and 3.5 mm high) with a small room (8–9 mm square, 1.0–1.5 mm high) and four holes of 1.6–1.8 mm diameter was used as the mite cage (Fig. 1). Japanese paper was adhered to one side of the cage using rice glue. After the paste dried for three days, the cage was used in the following tests.

2-2. Contacting mites with human skin

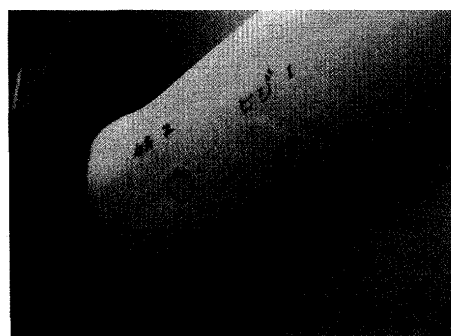
The paper-covered side of the cage was fixed with surgical tape. The mites were kept in a refrigerator for 5 min and placed in the cage gently using a small brush. The uncovered sides of the cages were fixed to the volunteers' arms



a



c



b



d

Photo 1. Appearance of contact test using intact mites (Test 1). The *Balaustium murorum* mites in the button cage were placed on human skin for 6 or 24 hours and the skin condition was observed until the fifth day after the removal of the cage.

a, the cage with mites affixed to human skin; b, immediately after cage removal; c, 1 day after cage removal; d, 2 days after cage removal

and kept for 6 or 24 hours to allow the mites to directly touch the skin (Fig. 1, Photo 1 a). The cage without mites (blank cage) was also fixed to each volunteer in 6-h contact test of 2009 and 24-h contact of 2010.

After the 6- or 24-h contact period, we unfixed the cages and checked the mites' condition, dividing them into four categories: (1) actively wandering (active); (2) moving their legs slightly (inactive); (3) motionless in the cages (dead); and (4) out of the cages (escaping). The mites were converted into specimens for stage confirmation. The condition of the attached skin was observed continuously until the fifth day after removal (Photo 1 b–d).

3. Test 2

Ten adult mites were crushed on each volunteer's arm using the bottom of a sterilized 40-mm Petri dish (Photo 2 a). The dish was fixed with surgical tape for 6 or 24 hours (Photo 2 b). A blank dish was also contacted with each volunteer as a check. After contact, the crushed mites

were removed and converted into specimens. The area of arm skin used in the test was washed with tap water, and its condition was observed continuously as described in Test 1.

4. Test volunteers

For the tests, four volunteers were used (Table 1). The male volunteers A, B and C participated in every test and the female volunteer D participated in tests with 6-h exposure. The volunteer A had experienced severe cheyletid mite-induced dermatitis (Yoshikawa, 1985; 1987). The tests were started at around 10 am, and each volunteer kept quiet during the tests.

RESULTS AND DISCUSSION

1. Test 1

1-1. Six-hour contact

The adult mites were placed in contact with skin in 2009 (Table 2), the percentage of "active" mites after 6-h contact was 49% (20/41). Three volunteers (A, B and C) experienced neither skin itching nor dermatitis. The volunteer D had a



a



b

Photo 2. Appearance of contact test using crushed mites (Test 2).

a, ten mites crushed on an arm by the bottom of a Petri dish; b, the Petri dish fixed to the arm with surgical tape for 6 or 24 hours.

Table 1. Volunteers in contact with the *Balaustium murorum* mite.

Volunteer	Gender	Age	Remarks
A	male	sixties	asthma, susceptible to allergy
B	male	sixties	hypertension
C	male	fifties	dry skin
D	female	thirties	no health problems

Table 2. Human skin changes after 6-hour contact with adult *Balaustium murorum* mites.

Volunteer ^a	Contact area	Date	Number of examined mites	Mite condition after contact				Skin condition after mite removal ^c	
				Active ^b	Inactive ^b	Dead ^b	Escaping ^b	Itchiness	Dermatitis
A	Left upper arm	22-May-09	4	2		2		-	-
	Right upper arm	29-May-09	4			4		-	-
	Right upper arm	8-Jun-09	1	1				-	-
	Left upper arm	8-Jun-09	2				2	-	-
B	Right upper arm	22-May-09	4	4				-	-
	Left upper arm	29-May-09	3	1	1		1	-	-
	Right upper arm	8-Jun-09	1	1				-	-
	Left upper arm	8-Jun-09	3	1		1	1	-	-
C	Left upper arm	22-May-09	3	3				-	-
	Left upper arm	29-May-09	2		1	1		-	-
	Right upper arm	8-Jun-09	4	2			2	-	-
	Left upper arm	8-Jun-09	1	1				-	-
	Left upper arm	8-Jun-09	2		1	1		-	-
D	Left upper arm	29-May-09	2			1	1	-	a small papule
	Right upper arm	12-Jun-09	1	1				-	-
	Right upper arm	12-Jun-09	1				1	-	a small papule
	Left upper arm	12-Jun-09	1	1				-	-
	Left upper arm	12-Jun-09	2	2				-	-
Total number of examined mites			41	20	3	10	8		
Percentage of "active" mites after contact			49%						

a Volunteers were also contacted with a cage without mites in each test. They did not have skin disorders after the blank contacts.

b Mite condition was divided into 4 categories: (1) actively wandering; (2) moving their legs slightly; (3) motionless in the cages; and (4) out of the cages. Mites were labeled as active, inactive, dead, and escaping, respectively.

c Each skin area was observed continuously until the fifth day after mite removal.

small non-itchy papule on her skin in two instances in which the caged mites were dead or escaping (Photo 3). The papules were not inflamed and disappeared in five days. It was not determined whether the papules were caused by mite biting. Any changes were not seen on their skin contacted with blank cages.

Three mite stages were fixed in 2010 (Table 3). The percentages of "active" larvae, nymphs, and adults were 61%, 92% and 67%, respectively. No volunteers experienced itching or dermatitis, including skin papules. These results differed from those described in Yoshikawa (1987): the cheyletid mite, *Cheyletus malaccensis*, caused lesions on four volunteers' skins after 5–6-h contact in many cases.

1-2. Twenty-four-hour contact

The percentage of "active" mites after 24-h contact was 22% (4/18) (Table 4), which was lower

than that of the 6-h contact. The volunteers A, B and C had neither itching nor dermatitis even in the presence of "active" mites. This finding differed from those involving living cheyletid mites (*C. malaccensis* and *Chelacaropsis* sp. contacted with four and six volunteers respectively), which bit human skin and caused severe dermatitis during 24-h contact (Yoshikawa, 1985).

2. Test 2

The volunteers had neither itchiness nor dermatitis after 6-h contact with crushed mites (Table 5). The volunteers A and B had neither after 24-h contact, but the volunteer C had a small red rash on both his arms (Photo 4). Any changes were not seen in their skin contacted with blank dishes after 6- and 24-h tests.

Ido et al. (2003) reported that *B. murorum* had stimuli in its body and that the dermatitis

Table 3. Human skin changes after 6-hour contact with three developmental stages of *Balaustium murorum*.

Mite stage	Volunteer	Contact area	Date	Number of examined mites	Mite condition after contact				Skin condition after mite removal ^c	
					Active ^b	Inactive ^b	Dead ^b	Escaping ^b	Itchiness	Dermatitis
Larva	A	Left upper arm	19-Apr-10	2	2				-	-
		Left forearm	19-Apr-10	2	1		1		-	-
	B	Left upper arm	20-Apr-10	2	2				-	-
		Left upper arm	20-Apr-10	1	1				-	-
		Left upper arm	20-Apr-10	2		1		1	-	-
	C	Left upper arm	19-Apr-10	2	1		1		-	-
		Left upper arm	19-Apr-10	2			1	1	-	-
	D	Left upper arm	19-Apr-10	2	1		1		-	-
Left upper arm		19-Apr-10	3	3				-	-	
Nymph	A	Left upper arm	10-May-10	3	3				-	-
		Left forearm	10-May-10	2	2				-	-
	B	Left upper arm	10-May-10	2	1		1		-	-
		Left upper arm	10-May-10	2	2				-	-
	C	Left upper arm	10-May-10	1	1				-	-
		Left forearm	10-May-10	1	1				-	-
	D	Left upper arm	10-May-10	1	1				-	-
		Left upper arm	10-May-10	1	1				-	-
Adult	A	Left forearm	18-May-10	2	2				-	-
		Left upper arm	18-May-10	3	1		2		-	-
	B	Left upper arm	18-May-10	1	1				-	-
		Left upper arm	18-May-10	2	2				-	-
	C	Left upper arm	18-May-10	2	2				-	-
		Left upper arm	18-May-10	2	2				-	-
	D	Left upper arm	19-May-10	1				1	-	-
		Left upper arm	19-May-10	2				2	-	-
Total number of examined larvae				18	11	1	4	2		
Percentage of "active" larvae after contact				61%						
Total number of examined nymphs				13	12	0	1	0		
Percentage of "active" nymphs after contact				92%						
Total number of examined adults				15	10	0	2	3		
Percentage of "active" adults after contact				67%						

b, c : same as Table 2

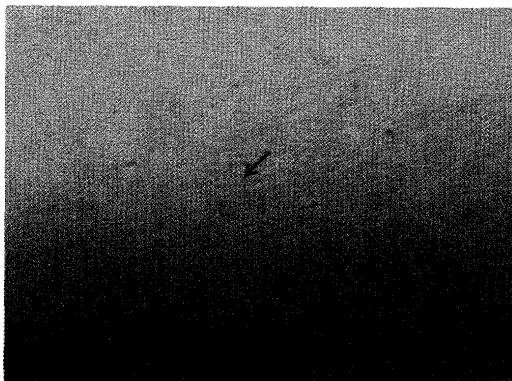


Photo 3. A small non-itchy papule on the skin of Volunteer D after 6-hour contact with mites in the button cage (Test 1). Arrow shows the papule.

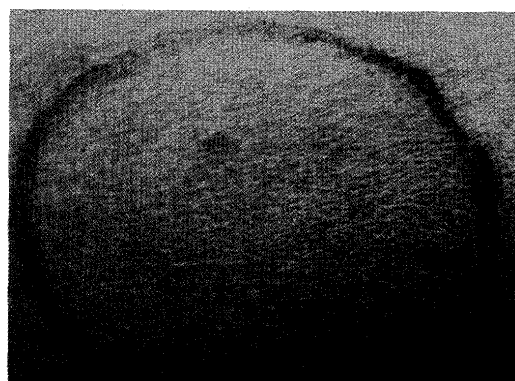


Photo 4. A red rash on the skin of Volunteer C after 24-hour contact with crushed mites (Test 2).

Table 4. Human skin changes after 24-hour contact with adult *Balaustium murorum*.

Volunteer ^a	Contact area	Date	Number of examined mites	Mite condition after contact				Skin condition after mite removal ^c	
				Active ^b	Inactive ^b	Dead ^b	Escaping ^b	Itchiness	Dermatitis
A	Left forearm	26-May-10	3	2		1		-	-
	Left upper arm	26-May-10	3			3		-	-
B	Left upper arm	26-May-10	3	1		2		-	-
	Left upper arm	26-May-10	3			3		-	-
C	Left upper arm	26-May-10	3	1		2		-	-
	Left upper arm	26-May-10	3			1	2	-	-
Total number of examined mites			18	4	0	12	2		
Percentage of "active" mites after contact			22%						

a, b and c : same as Table 2

Table 5. Human skin changes after 6- and 24-hour contact with crushed adult *Balaustium murorum*.

Volunteer	Body parts in contact with mites	Date	Contact time (h)	Number of crushed mites	Skin condition after mite removal ^c		Skin condition with no mites ^c Disorders
					Itchiness	Dermatitis	
A	Right forearm	2-Jun-10	6	10	-	-	-
B	Right forearm	2-Jun-10	6	10	-	-	-
C	Right upper arm	2-Jun-10	6	10	-	-	-
D	Left upper arm	14-Jun-10	6	10	-	-	-
A	Right forearm	26-May-10	24	10	-	-	-
B	Left forearm	26-May-10	24	10	-	-	-
C	Right forearm	26-May-10	24	10	-	a red rash	-
	Left forearm	2-Jun-10	24	10	-	a red rash	-

c : same as Table 2

experienced by a patient and nurses was due to crushing of mites on their skins. It seemed that the skin of the volunteer C absorbed the mites' body fluids a lot owing to his specific dry skin property. The rash appeared on the volunteer C was possible to be caused by the body fluids of this species.

3. Possibility of *B. murorum*-induced skin disorder

The results of present study indicate that living *B. murorum* seldom causes skin disorders, e.g. flare, swelling and itchiness, in the short term contacts. The results also suggest the presence of the risk of skin disorders caused by the body fluids of *B. murorum*. The frequency of such disorders is not high, but care should be taken to avoid crushing mites and to prevent the body fluids from touching skin.

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