

Additional Case Studies of Human Infestation with Hard Tick (Acarina: Ixodidae) Found in Okayama Prefecture, Japan

Ryo HATSUSHIKA, Tetsuya OKINO and Tsuyoshi KIHARA*

*Department of Parasitology Kawasaki Medical School,
Kurashiki 701-0192, Japan*

**Department of Medicine, Yakage Municipal Hospital,
Okayama 714-1201, Japan*

Accepted for publication on August 4, 1998

ABSTRACT. Two new cases of human infestation with hard tick (Acarina: Ixodidae) from Okayama Prefecture, Japan are further reported. Case 1: On August 20th., 1996, hard tick bite was found on the skin surface of left occipital region of a 61-year-old woman living in Bisei-Cho, Oda-Gun, Okayama Prefecture, Japan. The tick body removed from the patient measured 4.6 mm in length and 3.5 mm in maximum width. Case 2: On August 4th., 1997, hard tick bite was found on the skin surface of left nipple of a 64-year-old woman residing in Kurashiki City, Okayama Prefecture, Japan. The tick body collected from the patient measured 5.2 mm in length, 6.4 mm in maximum width and about 5.2 mm in height. On acarological observation, the ticks found from those 2 patients were identified as adult females of *Haemaphysalis longicornis* Neumann, 1901 based on morphological characteristics of capitulum, scutum, internal and external spurs on coxae, genital aperture and spiracular plates. The tick bites seemed to have happened on hilly area in Case 1, while the site of bite was not clear in Case 2. No essential change of systemic symptoms other than tick bite wounds was recognized in those 2 patients.

To our best knowledge, the present report constitutes the 29th and 30th findings of human infestation with hard tick in Okayama Prefecture, Japan.

Key words: human tick bite — *Haemaphysalis longicornis* — Ixodidae — Acarina — Okayama Prefecture

Ixodid hard ticks have so far been recorded approximately 660 species in some 14 genera throughout the world (Harwood and James, 1979).¹⁾ Among them, 40 species have been collected in Japan (Yamaguti, 1977).²⁾ In general, the most ixodid hard ticks inhabit in hills and fields, and many species of them have a wide range of hosts. Individuals of larval and adult stages are bloodsucking ectoparasites of numerous wild mammals, avians, reptiles and amphibians. It is well known that hard ticks induce bite wounds on human skin and also inject various kinds of agential organisms of microbial diseases into human skin.

In Japan, human tick bites have gradually been increasing in recent years in relation to Lyme disease (Nakao and Miyamoto, 1990),³⁾ and Japanese spotted fever (Mahara and Fujita, 1989)⁴⁾ in Hokkaido and Nagano Prefectures. Thus, over 600 infestation cases have been reported in the literature. The

pathogenic microorganisms of *Borrelia burgdorferi* (Lyme disease) and *Rickettsia japonica* (Japanese spotted fever) have been discovered from adult tick bodies of 8 species in 4 genera collected in Hokkaido (Inaoka and Nakao, 1993)⁵⁾ and Tokushima⁴⁾ Prefectures, Japan.

In this paper, 2 additional human cases of hard tick infestation in Okayama Prefecture are described together with bibliographical consideration.

CASE NOTES

Case 1: The patient (T.K.) was a 61-year-old woman living in Bisei-Cho, Oda-Gun, Okayama Prefecture, Japan. Several days before visiting hospital, she noticed the presence of a foreign substance like a hard verruca on the skin surface of left occipital region with mild itchiness. She then visited Yakage Municipal Hospital on August 20th., 1996. By cutaneous findings, the infestation was found on the skin surface of her left occipital region. The lesion was slightly elevated from the skin surface with a 5th. finger-sized reddish swelling around the lesion, and a hard tick was recognized in the center of the swelling. The easily removed tick body was glossy and dark-grey in color, and the body had been slightly swollen by sucking the patient's blood. The tick was then boiled for 20 min in a 10% aqueous solution of NaOH and dehydrated in alcohol, and mounted in Canada balsam.

The tick body was relatively small in size, and morphological characteristics of the tick were: the body including capitulum was about 4.6 mm in length and 3.5 mm in maximum width (Fig 1a, b); capitulum at an anterior end was triangular in shape (Fig 1c); palpal segment II protruded laterally beyond the basis capituli and porous area were fairly distinct (Fig 1a, c); scutum on the anterior back almost round-shaped in dorsal view and lacking eyes (Fig 1a); hypostome almost equal in length to palps (Fig 1c); genital aperture present on the antero-ventral surface (Fig 1b, c); internal spurs on coxa I sharply pointed (Fig 1c) and spiracular plates elongated antero-posteriorly.

Judging from the examined characteristics, the tick was identified as an adult female of *Haemaphysalis longicornis* Neumann, 1901. The patient was then treated with an ointment Rinderon VG[®]. The tick bite lesion was healed in several weeks after the treatment, and no conspicuous change of the general symptoms was found thereafter. The patient had been frequently strolling through a hillside path nearby her residence with a pet dog.

Case 2: The patient (A.O.) was a 64-year-old woman residing in Tamashima, Kurashiki City in Okayama. On August 5th., 1997, the patient first noticed the presence of a hard substance on the surface of her left nipple without local pain. The following day the patient was enrolled to her family physician and diagnosed as hard tick bite.

By cutaneous finding, no inflammatory reaction by the bite was recognized on the bitten site. The tick was removed and sent to our laboratory through Okayama Medical Laboratory for taxonomical identification. The removed tick body was glossy and deep-brown in color, and the body had been fully swollen by bloodsucking (Fig 2). The body measured about 8.3 mm in length excluding capitulum, 6.4 mm in maximum width and 5.2 mm in height dorso-ventrally.

By acarological observation, the tick showed the following characteristics: the capitulum was not long as that of the genus *Ixodes*, and hypostome almost equalled to palps in length (Fig 2b); internal spur on coxa I was distinctly longer than that of other 3 coxae; genital aperture was recognized on the ventro-anterior surface of the body and spiracular plates elongated antero-posteriorly. Judging from the morphological features, the tick was identified as an adult female of *Haemaphysalis longicornis* Neumann, 1901. There was no remarkable change so far in systemic symptoms of the patient.

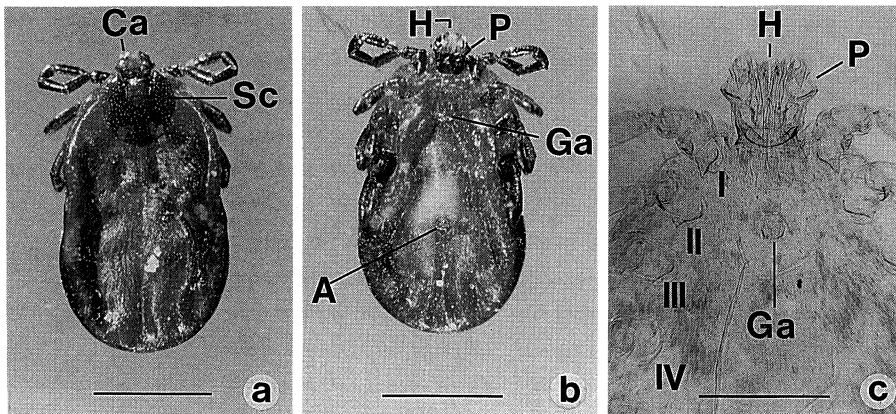


Fig 1. An adult female of *Haemaphysalis longicornis* removed from skin surface of left occipital region of the patient Case 1. Dorsal view (a), ventral view (b) (Bars=3.0 mm) and the anterior portion of tick body treated with a 10% NaOH solution, ventral view of mounted specimen (c) (Bar=1.0 mm)
 A : anus, Ca : capitulum, Ga : genital aperture, H : hypostome, P : palp, Sc : scutum, I-IV : coxae I to IV

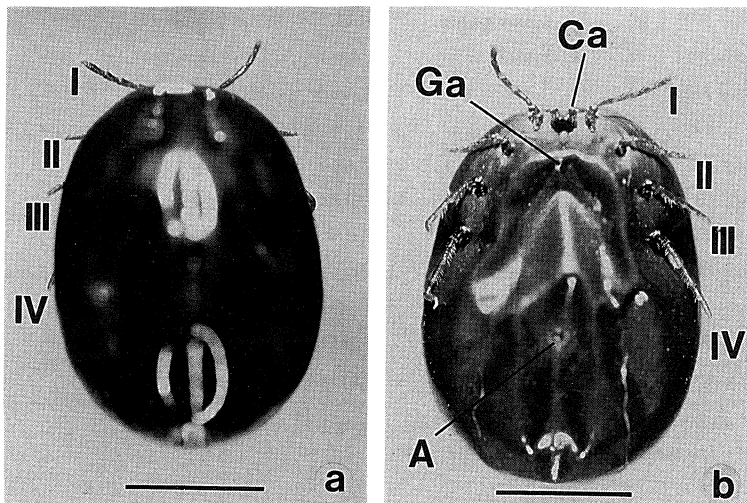


Fig 2. An adult female of *Haemaphysalis longicornis* removed from skin surface of left nipple of the patient Case 2. Dorsal view (a) and ventral view (b) (Bars=2.0 mm)
 A : anus, Ca : capitulum, Ga : genital aperture, I-IV : legs I to IV

Although the patient had been fully occupied with farming, she could not recall exact date of tick bite occurred.

TABLE 1. Hard tick bites recorded in Okayama Prefecture (1981-1997)

Consecutive case nos.	Examined dates	Patients			Lesion sites	Species	Authors (years)
		ages	sexes	locations			
1	June 1981	59	F	Aida-Gun	Right shoulder	<i>I. ovatus</i>	Hatsushika & Miyoshi (1982) ⁷⁾
2	June 1984	75	M	Wake-Gun	Left axilla	<i>I. nipponensis</i>	Nakatsukasa & Hatsushika (1985) ⁸⁾
3	Dec. 1984	2	M	Okayama City	Right temple	<i>H. flava</i>	Mimura & Hatsushika (1986) ⁹⁾
4 ^Δ	May 1983	74	M	Tamano City	Scrotum	<i>H. longicornis</i>	Tomono (1986) ¹⁰⁾
5 ^Δ	Nov. 1985	5	M	Kurashiki City	Vertex	<i>H. flava</i>	
6	June 1987	4	M	Maniwa-Gun	Left vertex	<i>H. flava</i>	Hatsushika & Mimura (1987) ¹¹⁾
7*	Apr. 1983	(child)	?	Okayama City	Neck	<i>H. longicornis</i>	Hatsushika <i>et al</i> (1990) ¹²⁾
8	Aug. 1987	78	F	Takahashi City	Right axilla	<i>H. longicornis</i>	
9	Oct. 1987	50	F	Okayama City	Upper shoulder	<i>H. flava</i>	
10	May 1988	38	F	Okayama City	Right post-auricula	<i>I. nipponensis</i>	
11	May 1989	4	M	Okayama City	Left post-auricula	<i>H. longicornis</i>	
12	May 1989	24	M	Okayama City	Right femur	<i>H. longicornis</i>	
13*	Apr. 1990	62	M	Tamano City	Femur & arm	<i>H. longicornis</i>	Hatsushika <i>et al</i> (1990) ¹³⁾
14	Apr. 1990	3	M	Okayama City	Right occiput	<i>H. longicornis</i>	Hatsushika <i>et al</i> (1990) ¹⁴⁾
15	June 1990	66	F	Soja City	Left shoulder	<i>I. nipponensis</i>	
16*	June 1991	58	M	Wake-Gun	Left upper eyelid	<i>I. ovatus</i>	Hatsushika <i>et al</i> (1993) ¹⁵⁾
17	June 1991	85	F	Kurashiki City	Neck	<i>H. flava</i>	
18	July 1991	54	F	Aida-Gun	Right abdomen	<i>I. nipponensis</i>	
19	Apr. 1992	74	F	Ibara City	Left rump	<i>H. flava</i>	
20	June 1992	68	F	Maniwa-Gun	Neck	<i>I. ovatus</i>	
21	June 1993	76	M	Kurashiki City	Left breast	<i>I. nipponensis</i>	
22 ^Δ	June 1993	63	F	Tsuyama City	Left neck	<i>H. longicornis</i>	Miyamoto (1994) ¹⁶⁾
23 ^Δ	July 1993	51	M	Tsuyama City	Right abdomen	?	
24 ^Δ	July 1993	32	M	Tsuyama City	Toes	<i>H. longicornis</i>	Hatsushika & Miyoshi (1996) ¹⁷⁾
25	Aug. 1993	81	M	Okayama City	Right femur	<i>H. longicornis</i>	
26*	Nov. 1994	6 (month)	M	Aida-Gun	Vertex	<i>H. flava</i>	Hatsushika <i>et al</i> (1996) ¹⁸⁾
27	Aug. 1995	45	F	Kurashiki City	Ear canal	<i>H. longicornis</i>	
28 ^Δ	June 1997	73	F	Kurashiki City	Ear canal	<i>H. longicornis</i>	Higashiyama <i>et al</i> (1998) ¹⁹⁾
29	Aug. 1996	61	F	Oda-Gun	Occiput	<i>H. longicornis</i>	Present report (1998)
30	Aug. 1997	64	F	Kurashiki City	Left nipple	<i>H. longicornis</i>	

* = Cases of nymphal tick infestation Δ = Cases reported from other institutions

I = *Ixodes*, *H* = *Haemaphysalis*, F = female, M = male

DISCUSSION

Hard ticks are taxonomically classified in Arachnida. The ticks are differentiable from insects as bodies are not entirely segmented, and both adult and nymphal stages have 4 pairs of legs, and the larvae 3 pairs. The ixodid hard tick develops into adult stage by incomplete metamorphosis passing through 3 developmental stages as egg, larva and nymph. Adult females of the ixodid tick lay eggs on ground surface after full sucking of host blood. The individuals in the all developmental stages such as larva, nymph as well as adult have a tendency to suck animal blood and frequently communicate various kinds of microbial diseases to man.

As mentioned above, the hard tick (Ixodidae) infestation has recently been increasing in Japan. Thirteen species of the bite sources have been recorded in Japan,⁶⁾ namely *Ixodes ovatus* Neumann, 1899, *I. persulcatus* Schulze, 1930, *I. nipponensis* Kitaoka and Saito, 1967, *I. acutitarsus* (Karsch, 1880), *Amblyomma testudinarium* Koch, 1844, *Haemaphysalis longicornis* Neumann, 1901, *H. flava* Neumann, 1897, *I. monospinosus* Saito, 1967, *H. campanulata* Warburton, 1908, *I. asanumai* Kitaoka, 1973, *H. japonica* Warburton, 1908, *H. hystricis* Supino, 1897 and *Rhipicephalus sanguineus* Latreille, 1806 in the order of appearing frequency.

As shown in Table 1, the first human case of hard tick infestation in Okayama Prefecture was reported by Hatsushika and Miyoshi (1982)⁷⁾ of a 59-year-old woman living in Aida-Gun. Since then, 28 more cases have been recorded in literature,⁸⁻¹⁹⁾ as well as 6 other cases (2 by Tomono, 1986¹⁰⁾; 3 by Miyamoto, 1994¹⁶⁾ and one by Higashiyama *et al*, 1998¹⁹⁾. Thus, totally 30 cases including the present 2 cases are recognized, however, it is assumed that numerous unreported cases may remain.

While examining Table 1, the tick bodies removed from 30 patients were identified as adult females excluding 4 cases of nymphal tick bites (case nos. 7, 13, 16 and 26), of which the case no. 13 was of 2 individuals infestation.¹³⁾ The hard tick infestation in Okayama Prefecture are occurred exclusively within a period of April to August except for 4 cases (case nos. 3, 5, 9 and 26). This fact seems to support the opinion that frequency of human outdoor activity corresponds closely with activation period of hard ticks as pointed out by Yamaguti (1989).⁶⁾ All of the victims were in ages between 6 months old infant and 85 years old, and the highest incidence occurred in the people above 50 years old or children under 10 years old. The age distribution in 30 victims is practically similar to the previous data of 13 cases reported by us (1990).¹⁴⁾ Sex ratio of 30 infested patients is equal. Although the tick bite wounds in the present 2 cases were found respectively, on the skin surface of the occipital region (Casa 1) and left nipple (Case 2), the infested lesions of 30 patients were predominantly skin surface of upper body, such as, head and neck (15 cases), followed by trunk including scrotum (11 cases) and both upper and lower extremities (5 cases).

The sum total of 4 ixodid species (*I. ovatus*, *I. nipponensis*, *H. longicornis* and *H. flava*) are removed and identified from 30 patients in Okayama Prefecture, of which the infestation with *H. longicornis* was most abundant (14 cases), followed by *H. flava* (7 cases) and *I. nipponensis* (5 cases), whereas *I. ovatus* infestation was rare as shown in Table 1. The human cases of *I. ovatus*

infestation have commonly been found in Japan,⁶⁾ yet the infested case with *I. ovetus* is so few in Okayama Prefecture. The reason for this notable discrepancy is not well understood. Moreover, no definite statement is known on an exact relationship between location of infestation occurred and species of the ticks bite, though it has been known that some ixodid species seem to have a tendency to choose biting sites of the victims.

As mentioned above, pathogenic microbes (*Rickettsia japonica*) of Japanese spotted fever have been discovered in the adult tick bodies of 8 species; *H. flava*, *H. formosensis* Neumann, 1913, *H. hystricis*, *H. longicornis*, *A. testudinarium*, *Dermacentor taiwanensis* Sugimoto, 1936, *I. nipponensis* and *I. ovatus* collected in Tokushima Prefecture, Japan.⁴⁾ Accordingly, the special attention must be paid for Japanese spotted fever and other relevant diseases by tick bites when a physician was accidentally encountered clinical cases of ixodiasis. For this reason, further study of taxonomical identification of the agential ticks as well as continuous examination of the patient bodies are requested.

REFERENCES

- 1) Harwood RF, James MT: Entomology in human and animal health (7th ed). New York, Macmillan. 1979, pp. 371-416
- 2) Yamaguti N: Key to the Japanese ticks of Ixodidae. In advances on acarology (ed. by Sasa M and Aoki J). Tokyo, Hokuryu-Kan. 1977, pp. 451-472 (in Japanese)
- 3) Nakao M, Miyamoto K: Lyme disease and its vectors in Hokkaido. Clin Parasitol 1: 152-154, 1990 (in Japanese)
- 4) Mahara F, Fujita H: Japanese spotted fever: Clinical features and vectors. Saishin-Igaku 44: 916-919, 1989 (in Japanese with English summary)
- 5) Inaoka T, Nakao M: Detection of *Borrelia burgdorferi* from tabanids and ixodid ticks in Hokkaido, Japan. Jpn J Sanit Zool 44: 45-47, 1993
- 6) Yamaguti N: Human tick bite: Variety of tick species and increase of cases. Saishin-Igaku 44: 903-908, 1989 (in Japanese with English summary)
- 7) Hatsushika R, Miyoshi K: A case of human infestation with hard tick *Ixodes ovatus* in Okayama, Japan (Acarina: Ixodidae). Jap Med J 3012: 31-34, 1982 (in Japanese)
- 8) Nakatsukasa A, Hatsushika R: A case report on the human infestation by a hard tick *Ixodes nipponensis* found in Okayama, Japan (Acarina: Ixodidae). Kawasaki Med J 11: 225-231, 1985
- 9) Mimura S, Hatsushika R: Child infestation with the hard tick *Haemaphysalis flava* (Acarina: Ixodidae) found in Okayama, Japan. Kawasaki Med J 12: 61-66, 1986
- 10) Tomono H: Two cases of human tick bite. Acta Derm 81: 619-620, 1986 (in Japanese)
- 11) Hatsushika R, Mimura S: An additional case study of child infestation with the hard tick *Haemaphysalis flava* (Acarina: Ixodidae) found in Okayama, Japan. Kawasaki Med J 13: 207-212, 1987
- 12) Hatsushika R, Miyoshi K, Takei Y, Nakatsukasa A: Six tick bite cases from Okayama, Japan. Jpn J Sanit Zool 41: 113-115, 1990 (in Japanese with English summary)
- 13) Hatsushika R, Oka D, Okino T: A case study of nymphal tick *Haemaphysalis longicornis* Neumann, 1901 (Acarina: Ixodidae) infestation found in Okayama, Japan. Kawasaki Med J 16: 57-63, 1990
- 14) Hatsushika R, Miyoshi K, Hamasaki Y, Kanzaki M: Additional two case studies of human infestation with hard tick (Acarina: Ixodidae) found in Okayama, Japan. Kawasaki Med J 16: 217-223, 1990
- 15) Hatsushika R, Miyoshi K, Okino T, Oka D, Kikuchi R: Further case studies of human infestation with hard tick (Acarina: Ixodidae) found in Okayama, Japan. Kawasaki Med J 19: 21-30, 1993
- 16) Miyamoto T: Three cases of tick bite. M J Tsuyama C H 8: 103-104, 1994 (in Japanese)
- 17) Hatsushika R, Miyoshi K: Two tick bite cases from Okayama, Japan. Med Entomol Zool 47: 83-86, 1996 (in Japanese with English summary)
- 18) Hatsushika R, Hyo Y, Okino T: A case study of external auditory meatus infestation

- with hard tick (Acarina : Ixodidae) found in Okayama Prefecture, Japan. *Kawasaki Med J* **22** : 179-185, 1996
- 19) Higashiyama E, Orita Y, Akisada T, Yoshihiro T, Kawai A, Oku M: A tick in the external auditory canal; A case report. *Pract Otol (suppl)* **96** : 71-75, 1998 (in Japanese with English summary)