

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

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ABSTRACT. Six new cases of human infestation with hard tick (a 58-year-old man, a 85-year-old woman, a 54-year-old woman, a 74-year-old woman, a 68-year-old woman and a 76-year-old man) from Okayama Prefecture are further reported. The tick bites were found on the skin surface of left upper eyelid (Case 1), neck region (Cases 2 and 5), right abdomen (Case 3), left rump (Case 4) and left thorax (Case 6). On acarological observation, the removed ticks were identified as *Ixodes ovatus* Neumann, 1899 at nymphal stage (Case 1), the adult female of *Haemaphysalis flava* Neumann, 1897 (Case 2), *Ixodes nipponensis* Kitaoka and Saito, 1967 (Cases 3 and 6), *H. flava* (Case 4) and *I. ovatus* (Case 5) based on morphology of capitulum (hypostome and palps), internal and external spurs on coxae, spiracular plates and genital aperture. The tick bites have been occurred on hilly area (Cases 1 and 3), on farm garden (Case 2), and on grassy plain (Cases 5 and 6). The location of bite acquisition of Case 4 is not reported.

To our best knowledge, the present report deals with 14th to 19th findings of human infestation with hard tick in Okayama Prefecture, Japan.

Key words: human tick bite — *Ixodes ovatus* — *I. nipponensis* —
Haemaphysalis flava — Acarina

Over 500 cases of human tick bites have been recorded in Japan since 1927. Recently, Japanese spotted fever and Lyme disease caused by hard tick bite as well as tularemia have especially been pointed out with epidemiological attention in Japan. The first case of hard tick infestation in Okayama Prefecture was reported by Hatsushika and Miyoshi (1982),¹⁾ and thereafter a total of 13 cases have already been recorded by Hatsushika *et al* (1990).²⁾ In this report, additional six cases of the hard tick infestation in Okayama occurred between June 1991 and June 1993 are described together with photomicrographs of agential ticks by light and scanning electron microscopy.

CASE NOTES

The available data on each six cases were shown in Table 1.

TABLE 1. Hard tick infestation in Okayama Prefecture after 1991

Consecutive case nos.	Examined dates	Patients				Lesion sites	Tick species
		names	ages	sexes	locations		
14	June 1991	Y.H.	58	M	Wake-Gun	Left upper eyelid	<i>I. ovatus</i> *
15	June 1991	S.A.	85	F	Kurashiki City	Neck	<i>H. flava</i>
16	July 1991	M.H.	54	F	Aida-Gun	Right abdomen	<i>I. nipponensis</i>
17	Apr. 1992	?	74	F	Ibara City	Left rump	<i>H. flava</i>
18	June 1992	K.F.	68	F	Maniwa-Gun	Neck	<i>I. ovatus</i>
19	June 1993	Y.K.	76	M	Kurashiki City	Left thorax	<i>I. nipponensis</i>

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

Case 1: The patient (Y.H.) was a 58-year-old man living in Saeki-Cho, Wake-Gun in Okayama. On May 26th, 1991, the patient climbed mountain nearby his residence for plantation. On that evening, he noticed the presence of a small verruciform substance on skin surface of his left upper eyelid. In the following 7 days the wound had rapidly swollen 3-folds in size. He then visited Yunogo Clinic on June 4th, and was diagnosed as hard tick bite of which the tick body was easily removed. The lesion was elevated slightly from the skin surface with the fifth finger-sized edematous erythema around the worm body. The tick was then investigated at our laboratory. The specimen was externally observed before fixation.

The tick body measured about 5.2 mm in length (excluding capitulum) and 3.7 mm in maximum width, and no genital aperture was recognized. The tick was indentified as *Ixodes ovatus* Neumann, 1899 at nymphal stage by morphological characteristics of capitulum (hypostome and palps), internal and external spurs on coxae and spiracular plates (Fig. 1).

Case 2: The patient (S.A.) was a 85-year-old woman, a resident of Tamashima, Kurashiki City in Okayama. She worked in green farm almost every day, and she previously had hard tick infestation several years before. In early June 1991, the patient noticed the presence of a foreign substance on skin surface of her neck without any particular symptom. Then she visited Department of Dermatology, Kurashiki Central Hospital on June 22th, 1991, and was diagnosed as hard tick bite. The tick body was removed together with surrounded cutaneous tissue, and it was sent to our laboratory.

The tick body measured about 5.5 mm in length (excluding capitulum) and 4.0 mm in maximum width. Most legs of the body were accidentally left from the basal portion of trochanter and femur, although the tick was identified as an adult female of *Haemaphysalis flava* Neumann, 1897 (Fig. 2).

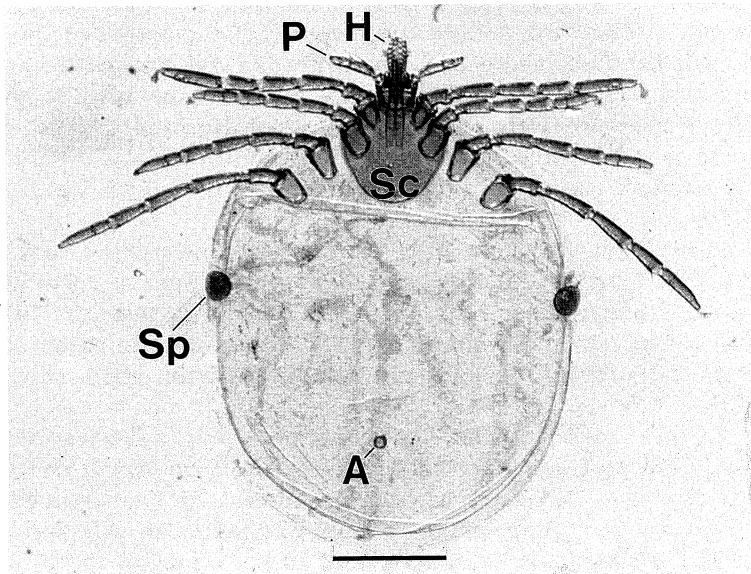


Fig. 1. A nymph of *Ixodes ovatus* removed from the skin surface of left upper eyelid of the patient Case 1, ventral view of mounted specimen (Bar=1.0 mm)

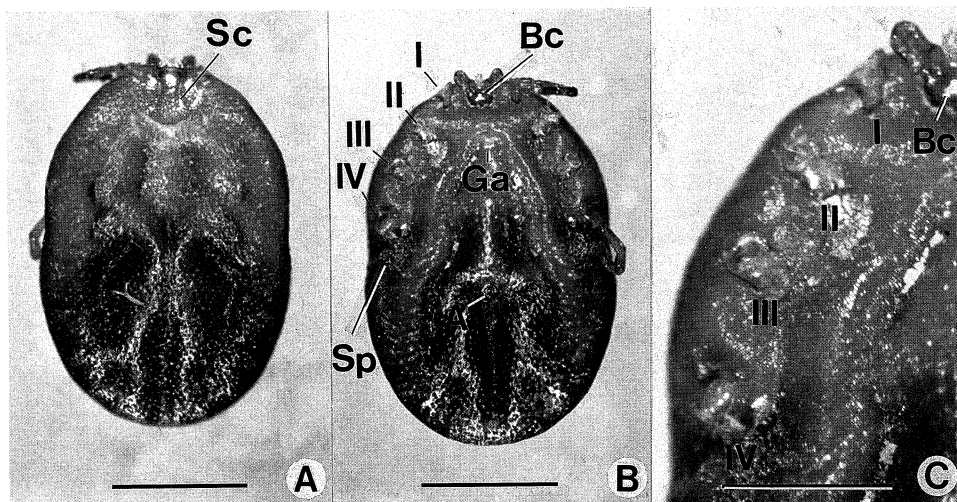


Fig. 2. An adult female of *Haemaphysalis flava* removed from the skin surface of neck region of the patient Case 2, dorsal view (A), ventral view (B) (Bar=2.0 mm) and right coxae, ventral view (C) (Bar=1.0 mm)

Case 3: The patient (M.H.) was a 54-year-old woman residing in Sakuto-Cho, Aida-Gun in Okayama. Since her family keeps cattle ranch, and she used to wander neighboring mountains for look after the cattle. On June 26th, 1991, the patient first noticed the presence of a papule-like substance on skin surface of her right abdomen. The following day the patient enrolled to local clinic, and was diagnosed as hard tick bite, thus, on July 1st, the patient visited Department of Dermatology, Kawasaki Hospital. The cutaneous findings were found in right abdomen, and an infiltrating erythematous papule the size of a thumb was found around the skin surface which was centered by the tick body.

The removed tick had been fully swollen by bloodsucking, and measured about 6.0 mm in length (excluding capitulum) and 4.0 mm in maximum width. The tick was identified as an adult female of *Ixodes nipponensis* Kitaoka and Saito, 1967 based on the morphology of capitulum, internal spurs and spiracular plates examined by light and scanning electron microscopy (Figs. 3, 4).

Case 4: The patient (name not confirmed) was a 74-year-old woman residing in Nishikata-Cho, Ibara City in Okayama. On April 17th, 1992, the patient having vague ill feeling visited Department of Dermatology, Yakage Hospital. An indolent erythematous papule was found on skin surface of her left rump, and the hard tick was recognized in the center of the papule. The removed tick was sent to our laboratory through Okayama Medical Laboratory for taxonomical evaluation. The tick which did not fully suck up blood, measured about 3.2 mm in length (including capitulum) and 2.3 mm in maximum width. The tick was identified as an adult female of *H. flava* (Figs. 5, 6).

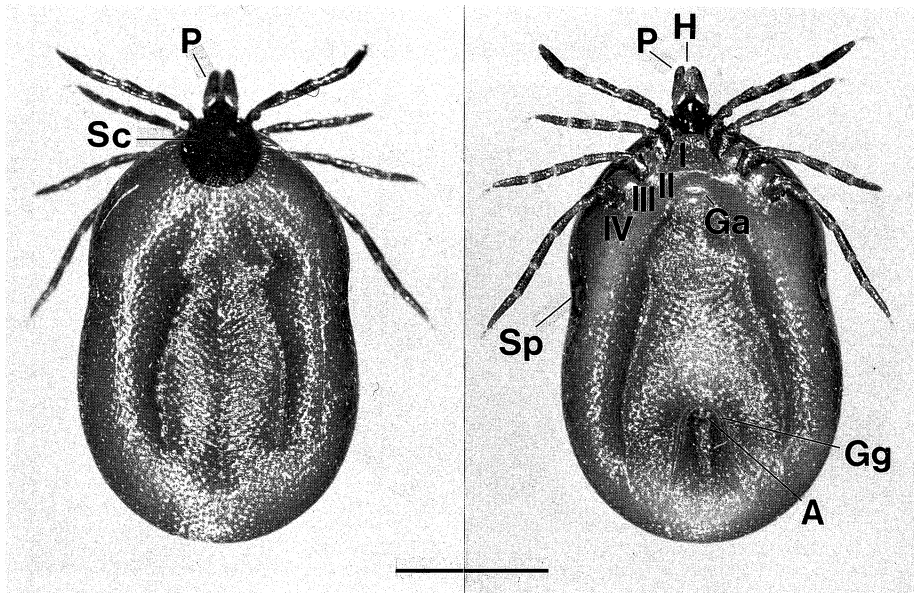


Fig. 3. An adult female of *Ixodes nipponensis* removed from the skin surface of right abdomen of the patient Case 3, dorsal view (left) and ventral view (right) (Bar=2.0 mm)

Case 5: The patient (K.F.) was a 68-year-old woman living in Katsuyama-Cho, Maniwa-Gun in Okayama. On June 18th, 1992, the patient first noticed the presence of a hard substance on skin surface of her neck region without serious pain. The following day she visited Department of Dermatology, Katsuyama Hospital and was diagnosed as hard tick bite. The removed tick body was sent to our laboratory through Okayama Medical Laboratory for taxonomical judgement. The tick body was purple-brown in color, and measuring about 5.0 mm length (excluding capitulum) and 3.5 mm in maximum width. Although the distal portions of several legs were accidentally missing, the tick was identified as an adult female of *I. ovatus* (Figs. 7, 8).

Case 6: The patient (Y.K.) was a 76-year-old man residing in Kurashiki City in Okayama. In the middle of June, 1993, the patient first noticed the presence of a foreign substance on skin surface of his left thorax after mowing work. The victim then visited Department of Surgery, Kurashiki Central Hospital on following June 23th. The foreign substance was removed and sent to our laboratory through Okayama Medical Laboratory for examination. The consulting surgeon of the patient recognized a round erythematous papule 1.0 cm in diameter on skin surface of his left thorax just below the collarbone, and the foreign substance (tick body) was found in the center of the papule.

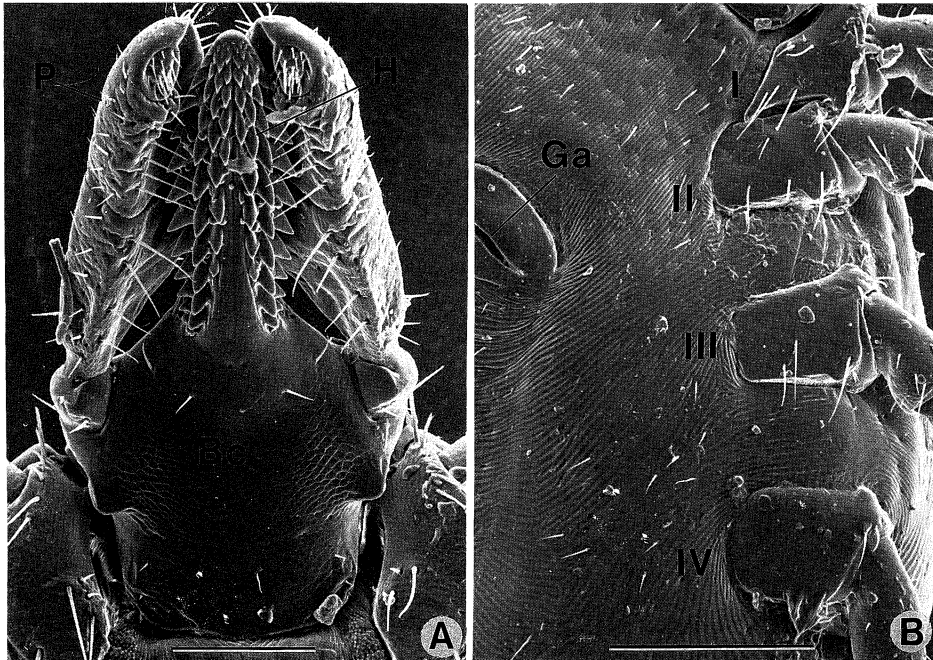


Fig. 4. SEM pictures of *I. nipponensis* from Case 3 showing an anterior end (capitulum), ventral view (A) (Bar=0.2 mm) and arrangement of internal spurs (left coxae), ventral view (B) (Bar=0.5 mm)

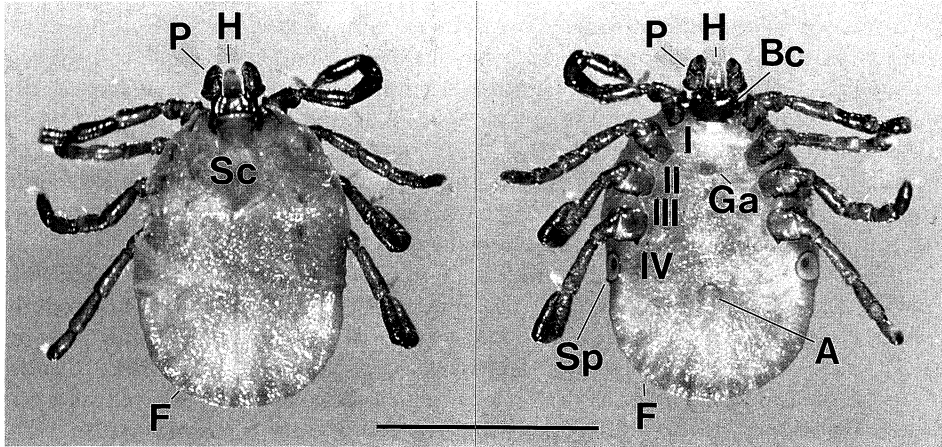


Fig. 5. An adult female of *Haemaphysalis flava* from the skin surface of left rump of the patient Case 4, dorsal view (left) and ventral view (right) (Bar=2.0 mm)

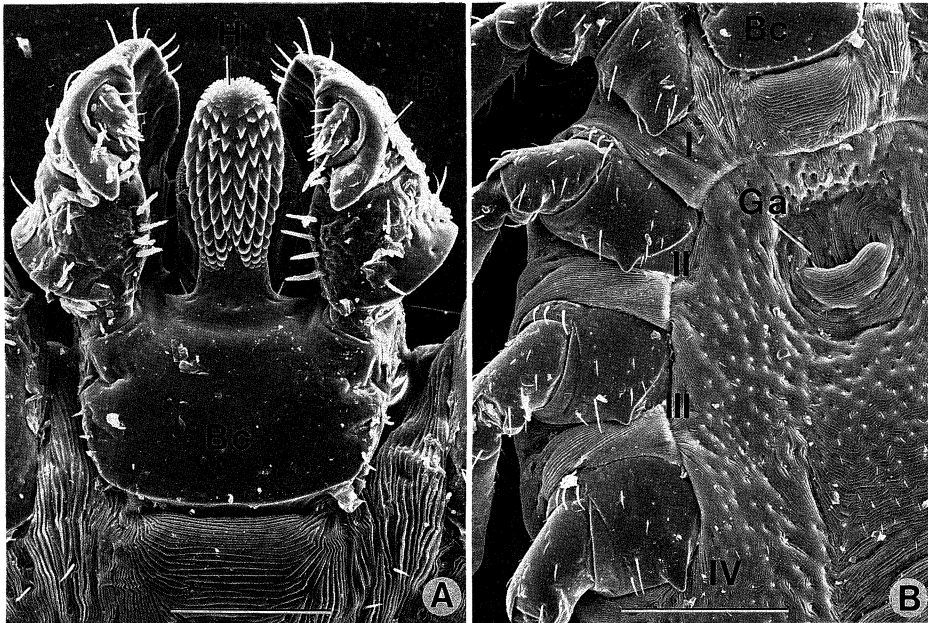


Fig. 6. SEM pictures of *H. flava* from Case 4 showing an anterior end (capitulum), ventral view (A) (Bar=0.2 mm) and arrangement of internal spurs (right coxae), ventral view (B) (Bar=0.5 mm)

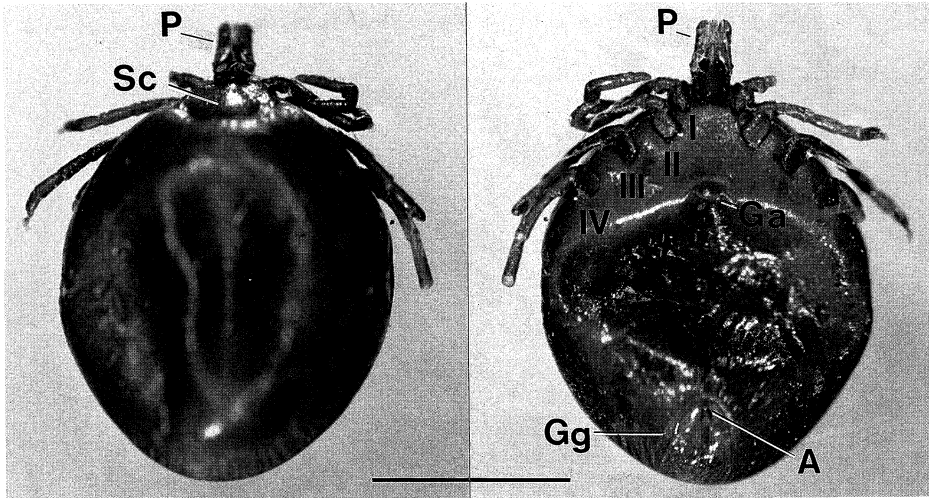


Fig. 7. An adult female of *Ixodes ovatus* removed from the skin surface of neck region of the patient Case 5, dorsal view (left) and ventral view (right) (Bar=2.0 mm)

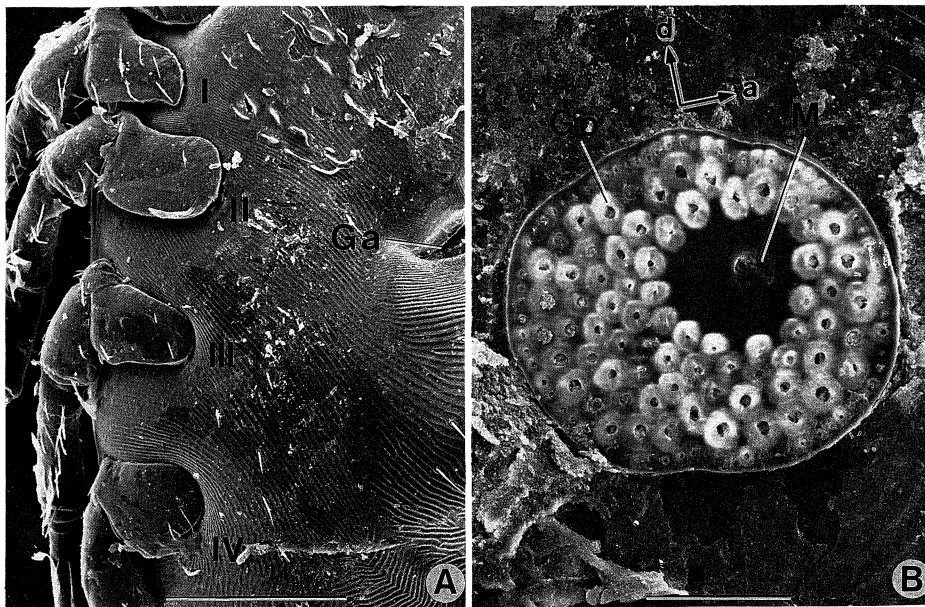


Fig. 8. SEM pictures of *I. ovatus* from Case 5 showing arrangement of internal spurs (right coxae), ventral view (A) (Bar=0.5 mm) and a right spiracular plate (B) (Bar=0.1 mm)

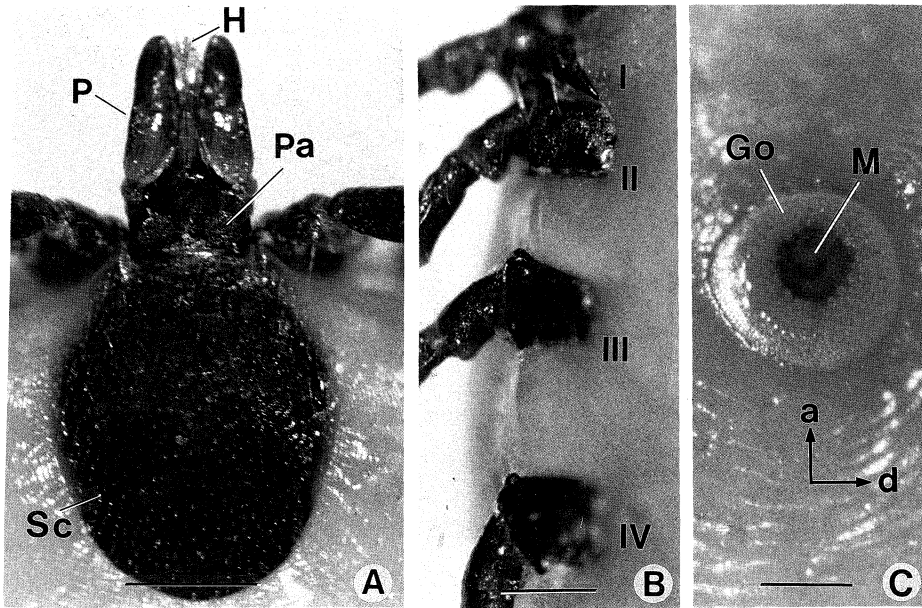


Fig. 9. An adult female of *Ixodes nipponensis* removed from the skin surface of right thorax of the patient Case 6, showing an anterior end (capitulum), dorsal view (A) (Bar=0.5 mm), internal spurs (right coxae), ventral view (B) (Bar=0.3 mm) and a left spiracular plate (C) (Bar=0.2 mm)

The removed tick body was bluish-gray in color, and the tick had been swollen by sucked blood. The tick body measured about 9.0 mm in length (excluding capitulum) and 6.0 mm in maximum width, and was identified as an adult female of *I. nipponensis* (Fig. 9).

DISCUSSION

Nearly 660 species of hard tick have been known world-wide (Harwood and James, 1979).³⁾ Among them, 15 species have so far been recorded as causative agents for human tick bite in Japan. The following predominant tick species of human bite source are demonstrated by Yamaguti (1989)⁴⁾ as *Ixodes ovatus*, *I. persulcatus* Schulze, 1930, *I. nipponensis*, *I. acutitarsus* (Karsch, 1880), *Amblyomma testudinarium* Koch, 1844, *Haemaphysalis longicornis* Neumann, 1901, *H. flava* and *I. monospinosus* Saito, 1967 in order of occurrence. Three species of hard ticks examined in the present study are among the above mentioned species.

The first human case of hard tick infestation in Okayama Prefecture was reported by Hatsushika and Miyoshi (1982)¹⁾ of a 59-year-old woman. Since then, 13 more cases have been recorded by Hatsushika *et al* (1990).²⁾ Thus totally 19 cases including 6 in the present report are recognized. We assume that there must be more incidents which have not been admitted to our laboratory.

As shown in Table 1, the hard tick bite reported here occurred in early summer which was similar to the previous report (Hatsushika *et al*, 1990).²⁾ Normally, the ixodid ticks develop by incomplete metamorphosis passing through 4 developmental stages from egg, larva, nymph to adult in 6 weeks to 3 years. Both of nymph and adult have 4 pairs of legs, the larva 3 pairs. It is believed that the bloodsucking behavior of the hard ticks corresponds to the time of their oviposition, consequently nearly all cases of the tick bite thus reported in Japan were by females. The fully developed adult females usually lay eggs on the ground as many as 18,000, averaging 2,000 to 8,000 after full absorption of blood from hosts (Harwood and James, 1979).³⁾ The individuals in larval and nymphal stages rapidly develop with a rise in temperature of the habitat, and begin attack against all vertebrates except fishes to suck blood. In the case of human, it occurs in forest, hilly areas, plains and on grass.

Woolley (1988)⁵⁾ has shown that tick-borne diseases can be classified principally into 6 types, (1) Rickettsial-rickettsiosis: Boutonneuse fever, Bullis fever, Maculatum disease, Spotted fever, (2) Viral-viral diseases: Russian spring-summer complexes (Powassan encephalitis, Negishi encephalitis, Langat encephalitis, Kyasuanur forest disease, Omsk hemorrhagic fever, Russian spring-summer encephalitis, central European tick-borne encephalitis, and louping ill), -arbovirus infections: Colorado tick fever, Q fever (9 mile fever), Crimean-Congo hemorrhagic fever, Kemerovo tick fever, and Tribee, (3) Bacterial, spirochaetal: relapsing fever, and Tularemia, (4) Protozoan: Texas cattle fever, (5) Helminthic infections (?) and (6) Toxicosis: Tick paralysis.

Although there have as yet been no reliable record documenting tick-borne disease in Japan, both Japanese spotted fever by rickettsial agents (Mahara and Fujita, 1989)⁶⁾ and Lyme disease by spirochaetal agents (Yamaguti, 1989)⁷⁾ attract attention from medical and public attention. The pathogenic microbe (*Rickettsia japonica*) of Japanese spotted fever has been discovered from adult tick body of 8 species in 4 genera; those are *Haemaphysalis flava*, *H. formosensis* Neumann, 1913, *H. hystricis* Supino, 1897, *H. longicornis*, *Amblyomma testudinarium*, *Dermacentor taiwanensis* Sugimoto, 1936, *Ixodes nipponensis* and *I. ovatus* collected in Tokushima Prefecture, Japan.⁶⁾ The etiological agent (*Borrelia burgdorferi*) of Lyme disease, on the other hand, has been detected in the adult tick body of *Ixodes persulcatus* and *I. ovatus* collected in Hokkaido, Japan (Inaoka and Nakano, 1993).⁸⁾

It has long been known that the individuals of *I. persulcatus* are found to be distributed in the northern districts and high mountain areas in Japan. However, very recently Takada *et al* (1993)⁹⁾ reported that the hard tick, *I. persulcatus* was widely found even in southwestern Japan; namely Kinki, Chugoku, Shikoku and Kyushu districts, but not in Okayama fortunately. The special attention must be paid for the tick-borne disease by participated physicians. For this reason, further study of identification of the agents and adequate checks of the patients are requested.

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Abbreviations used in Figures

A = anus	H = hypostome
a = anterior direction	I-IV = coxa I-IV
Bc = basis capituli	M = macula
d = dorsal direction	P = palp
F = festoon	Pa = porous area
Ga = genital aperture	Sc = scutum
Gg = genital groove	Sp = spiracular plate
Go = goblet	