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Amblyomma testudinarium Koch, 1844: Discovery and Record in Korea, and Identification and Redescription of Male Tick

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Introduction

No *Amblyomma* species has yet been recorded to occur in Korea although approximately one hundred species of the genus *Amblyomma* were recorded all over the world. On the 28th June in 1981, however, a strange, ornate and irregularly punctuated, large sized tick was collected from grazing Frisian cattle of the Dae Weon Farm on Jeju Island.

The tick was sent to the Institute of Veterinary Research in Anyang for the identification of the species. The specimen was then identified as an unfed male of *Amblyomma testudinarium* Koch, 1844. Although this species was previousely known

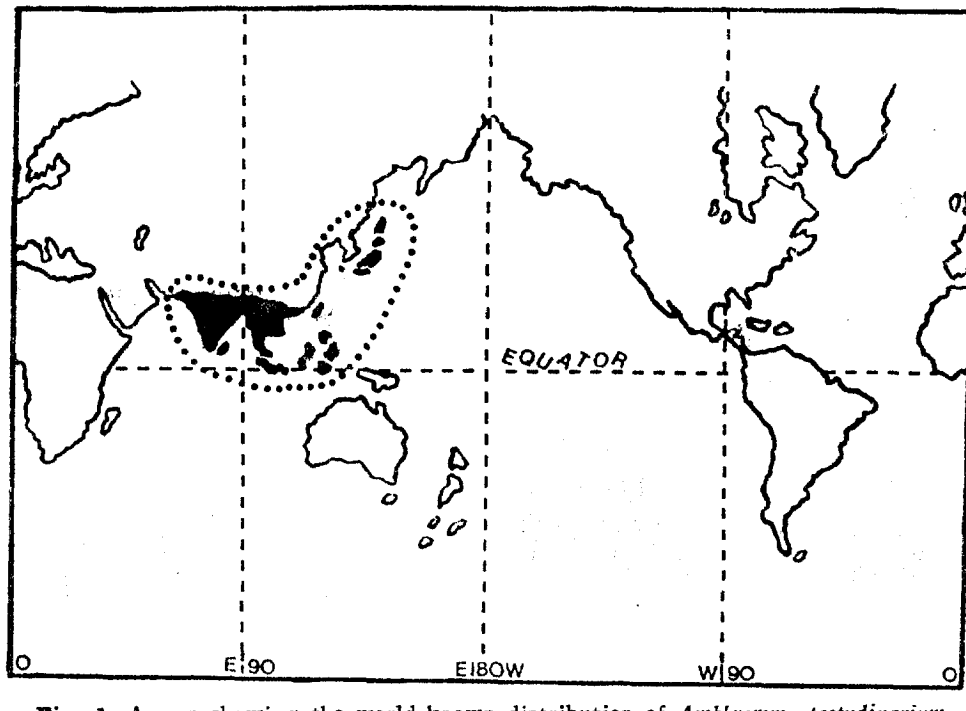

Fig. 1. A map showing the world known distribution of *Amblyomma testudinarium*.

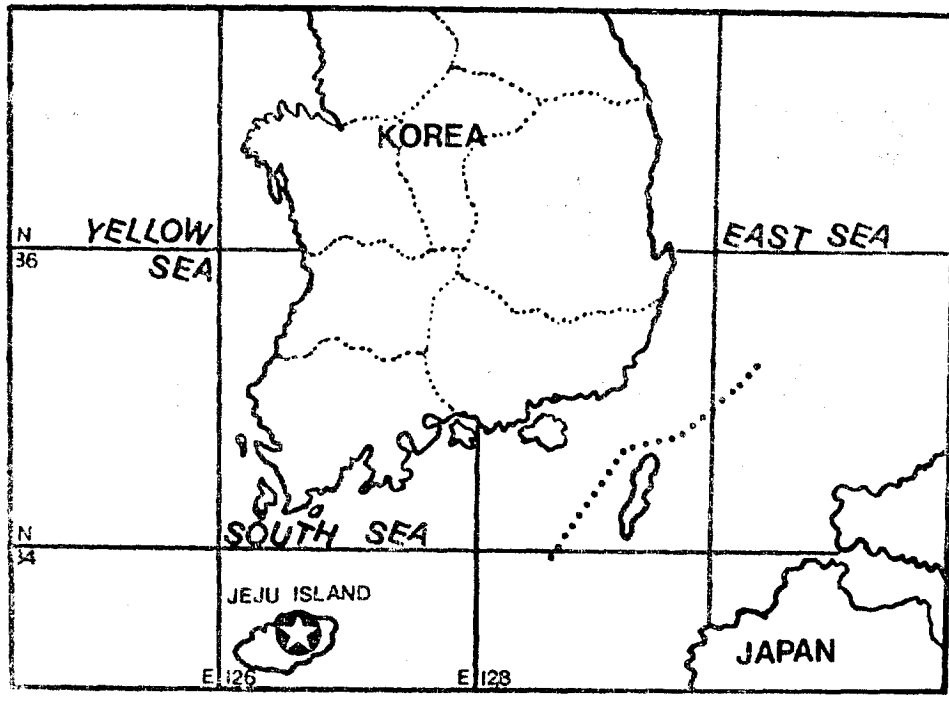

Fig. 2. A map showing the area in which the specimen of *Amblyomma testudinarium* discovered.

to occur in the Indian Peninsula, South East Asia including Burma, Thailand, Malaysia, Indonesia, the Philippines, Taiwan and Japan(Fig.1), the present discovery is the first recognition that the species occurs in the Republic of Korea.

Jeju Island located in the South Sea far from the Korean Peninsula is an intensive farming area for orange and live-stock industry, as the topography of the Island is mountainous and densely vegetated with a specialized subtropical fauna distinct from the mainland.

The presence of *A. testudinarium* on the Island implies that the warm temperature with heavy rainfall throughout the year and the subtropical vegetation fauna may be proper environmental condition for the tick.

In this report *A. testudinarium* is firstly recorded in Korea and the morphological characteristics of the male specimen are redescribed.

Materials and Methods

Specimen Examined: An unfed male tick was collected from grazing Frisian cattle of the Dae Weon Farm by one of the authors (H.-U. Lim), on the 28th June in 1981, and was sent to the Institute of Veterinary Research in Anyang for the examination, identification and description of the specimen.

Locality: The Dae Weon Farm is located in Gyorae-Ri, Jocheon-Myun, North Jeju District, on Jeju Island, and in a distance of approximately 24km south-east from Jeju City, the capital of the province(Fig. 2). The farm covers an area of 800 ha. at an altitude of 450m and stocks more than 150 Frisian cattle.

Examination: The specimen preserved in 70% ethyl alcohol was examined under a binocular stereoscopic microscope. A compound triocular microscope was also necessary for the finer details of some structures. The specimen was subjected to a light source directed from an illuminator. The intensity of light was able to be easy controlled and heating of the specimen was avoided. The specimen was handled with the aid of a pair of fine opthalmic forceps and a dissecting

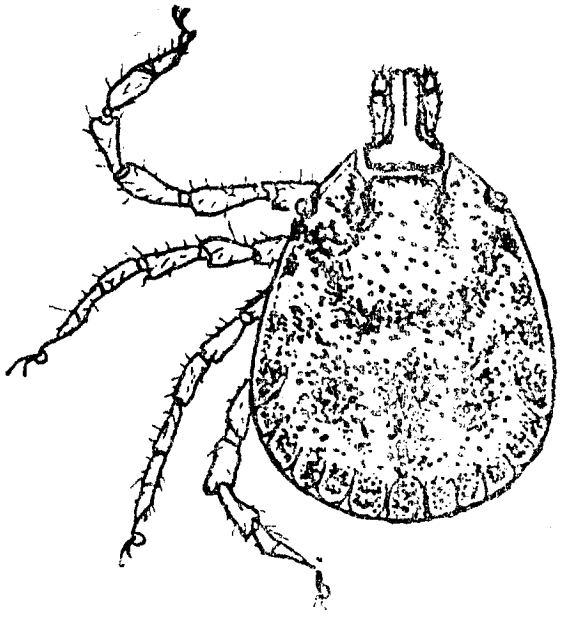

Fig. 3. Dorsal view of the male of *Amblyomma testudinarium* collected from cattle on Jeju Island, Korea.

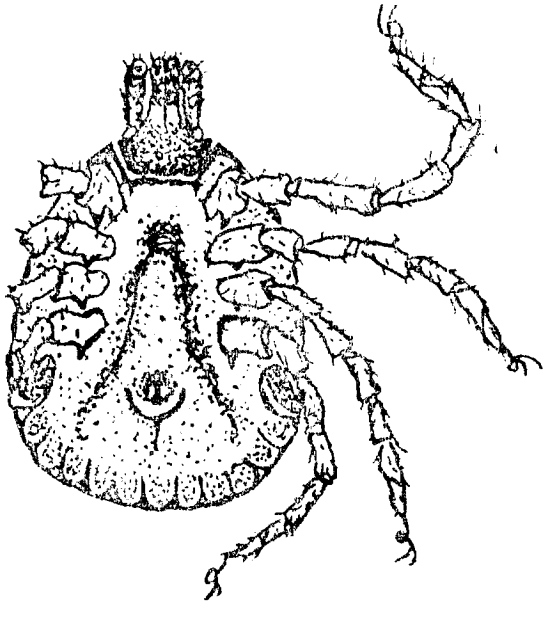

Fig. 4. Ventral view of the male of *Amblyomma testudinarium* collected from cattle on Jeju Island, Korea.

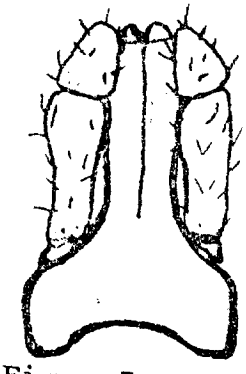

Fig. 5.

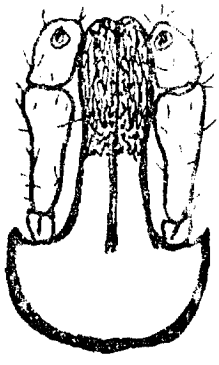

Fig. 6.

Fig. 7.

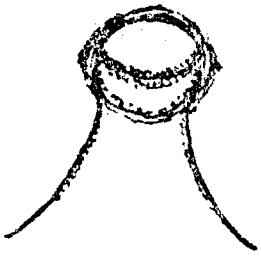

Fig. 8.

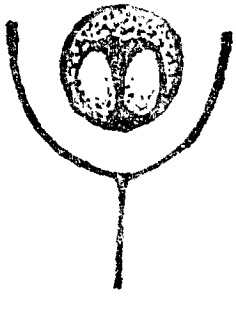

Fig. 9.

Fig. 5. to 9. Dorsal(5.) and ventral(6.) views of the capitulum ventral view of the hypostom (7.) and genital(8.) and anal(9.) areas of the male of *Amblyomma testudinarium* collected from cattle on Jeju Island.

Fig. 10.

Fig. 11.

Fig. 12.

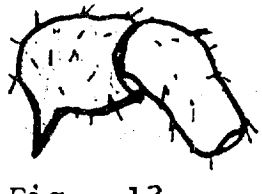

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

Fig. 17.

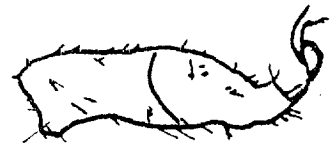

Fig. 18.

Fig. 19.

Figs. 10. to 19. Coxae and trochanters I to IV(10. to 13.), spiracular plate on left(14.), external views of the tarsi I to IV(15. to 18.) and internal view of the femur IV(19.) of the male of *Amblyomma testudinarium* collected from cattle on Jeju Island.

needle on a watch glass. Details of such structures as the capitulum, coxae, tarsi, anus, genital aperture and spiracular plate were more carefully examined and described.

Identification: Identification was mainly based on the morphological characteristics of the specimen. The specimen was identified according to the key to species of the genus *Amblyomma* Koch, 1844, (Campbell 1972)[3]; and the views of Hoogstraal (1956)[5], Roberts (1970)[17], Yamaguti et al (1971)[25] and Campbell (1977)[4] were helpful for the differential diagnosis of the specimen.

Redescription

Specimen: Male (Figs. 3. to 19).

Body (Figs. 3 and 4): Broad and subcircular; widest in region of spiracular plate where width is approximately 5 times that between scapulae; length from palpal apices to posterior scutal margin 6.1mm, breadth 5.2mm; few small hairs dorsally, a little more numerous ventrally; ventral shields absent.

Scutum(Fig. 3): Ornate; punctations irregular; dark brown spots with pale lateral margins on bright yellow background; lateral grooves represented by a short series of almost contiguous punctuations extending from external festoons and eyes; marginal groove absent; eyes not projecting beyond scutal contour; scapular angles not sharply pointed; pale areas extensive; festoons present with non-salient angles, widely formed, number 11.

Capitulum(Figs. 5, 6. and 7): Length 1.2mm; basis dorsally subrectangular, posterolateral margins curved, posterior margin straight; palps elongate with article 2 especially long; article 2 approximately 2.5 times as long as article 3; hypostome dentition 4/4, denticles of inner file much smaller than those of other files.

Genital aperture(Fig.8); On a level with coxa Ⅱ.

Anus(Fig. 9): On a level with posterior margin of spiracular plates; anal groove embracing anus posteriorly.

Legs(Figs. 10. to 13. and Figs. 15. to 19): Coxa Ⅰ with two medium sized subequal spurs, external spur longer than internal spur; coxa Ⅱ with a single broad salient ridgelike spur, much broader than long; coxa Ⅲ with a single spur, very similar to coxa II; coxa IV with a single spur, much longer than those of coxa II and coxa III; tarsi III and IV with two distinct subapical ventral spurs.

Spiracular plate(Fig. 14): Comma-shaped; posterolaterally to coxa IV; greatest dimension 0.9 mm.

Discussion

Throughout the world, approximately 100 species of the genus *Amblyomma* were recorded. The evidence provided those species with know natural life histories indicated that the ticks undergo usually three-host type(Anastos 1950,[1] Kohls 1950[13] and Hoogstraal 1956).[5]

Campbell (1972)[3] divided *Amblyomma* ticks into two groups such as Ethiopean species and non-Ethiopean species and presented an extremely useful identification key to the ticks.

Roberts (1970)[17] has reviewed Australian ticks and given a definition for the genus *Amblyomma* as that; usually ornate, with dark spots and stripes on a pale background; anal groove embracing the anus posteriorly; eyes and festoons present; palps usually elongate, with article 2 especially long; basis capituli of variable form, often subrectangular or subtriangular; males without ventral shields, but ventral plaques may be present; spiracular plates subtriangular or comma-shaped. Although a total of 12 *Amblyomma* species has been reported to occur in Australia, there is no record of *A. testudinarium*.

Three species of *Amblyomma* ticks have been reported in Japan, such as, *A. geoemydae* on tortoises, *A. nitidum* on sea snakes and *A. testudinarium* on larger wild and domestic mammals. The first collection of *A. testudinarium* was reported by Kishida(1922)[9] from a domestic pig in Tokyo and Robinson(1926)[18] reported some collections

Table 1. Ticks(7 Genera, 18 Species) Recorded in Korea

Species	Habitat or Host	Authority
Argas japonicus	Sleeping quarters	Yamaguti et al(1968)[24]
A. verspertilionis	Big brown bat	Kishida(1927)[10]
Amblyomma testudinarium	Cattle	Kang et al(1981)
Boophilus microplus (as *Palpoboophilus miningi*)	Cattle	Kishida(1936)[12]
Dermacentor coreus	Horse	*Keegan & Toshioka (1957)[8]
D. reticulatus	Pig	Kishida(1922)[9]
Haemaphysalis campanulata	Cattle & Horse	Nakamura & Yajima (1937)[15]
H. concinna	Unknown	Kishida(1936)[12]
H. flava	Unknown	Kishida(1936)[12]
H. japonica	Horse	Itagaki et al(1944)[6]
H. longicornis(as *H. bispinosa*)	Cattle, Horse & Hare	Ogura & Takada(1927)[16]
H. papuana	Dog	*Nakamura & Yajima(1937)[15]
Hyalomma aegypticum	Cattle	*Kishida(1936)[12]
Ixodes acuminatus	Unknown	*Kishida(1936)[12]
I. coreensis	Unknown	*Kishida(1936[12]
I. granulatus	Field mouse	Arthu(1957)[2]
I. persulcatus(as *I. ricinus*)	Unknown	Kishida(1936)[12]
I. verspertilionis	Horseshoe bat	Yamaguti et al(1971)[25]

* Doubtful records, not fully agreed.

of this species which had collected in 1912 from horse in Miyazaki(Takanabe) and Ryukyu Islands (Oshima). Later, Sugimoto (1937)[21] reported two collections of larvae from the frog and the green frog on Ishigaki Island in the Ryukyu Archipelago. Reviewing the host lists of *A. testudinarium* recorded by several workers, the findings reported by Sugimoto (1937)[20,21,22] are rather questionable that this species was parasitized on the reptiles in Japan. The known usual hosts are large sized wild animals including wild pigs, boars, deer, tigers, and rhinoceroes and domestic animals including cattle, horses, buffaloes, pigs and dogs. Some workers(Kawashima et al 1960,[7] Tanaka et al 1960[23] and Nagahana and Matsuo 1962)[14] have reported that this species also attacks man.

On the other hand, kishida(1935)[11] firstly described and illustrated the holotype female of *Amblyomma yajimai* collected from buffalo on Formosa(Taiwan) and gave diagnostic characters to separate it from *A. testudinarium*. A precise description of the holotype was given later by Nakamura and Yajima(1937)[15]. Same taxon was also used by Itagaki et al(1944)[6] for the report of collections from buffaloes(*Bubalus bubalis*) on Formosa. However, there is a different opinion (Anastos 1950)[1] that the taxon *A. yajimai* used by Japanese workers on the Formosan specimens is probably a synonym of *A. testudinarium* Koch, 1844. Two extensive reviews on the synonymy of *A. testudinarium* were given by Anastos(1950)[1] and Kohls(1950)[13]. Yamaguti et al (1971)[25] have suggested a simple identification key to the ticks in Japan and also presented an excellent view on *A. testudinarium*.

Sharif (1938)[19] reported *A. testudinarium* as a possible disease vector and later Anastos(1950)[1] reviewed the life cycle and disease relationship of this species and considered that this tick is a possible vector of babesiosis and anaplasmosis in animals. However, at present, there is no evidence that this species acts as a vector of any

diseases in Korea though they are surely ectoparasites on animals.

The morphological characteristics of the specimen examined by the authors in the present report was in accordance with that *A. testudinarium* in the identification key presented by Campbell (1972)[3] and was identical to the sample specimen among 21 species of *Amblyomma* in the Edinburgh University collections arranged by Campbell (1977).[4]

Making reference to the presence of *A. testudinarium*, a total of 18 species of ticks including some doubtful records has now been recorded to occur in Korea(Table 1.) and it is assumed that the Korean Peninsula is located functionally as a bridge for the geographical distribution of *A. testudinarium* between South East Asia and Japan.

Summary

Amblyomma testudinarium Koch, 1844, previousely known to occur in India, Sri Lanka, Burma, Thailand, Malaysia, Indonesia, Indochina, the Philipines, Taiwan and Japan, is here firstly discovered and recorded in Korea.

A male specimen was collected from grazing Frisian cattle of the Dae Weon Farm on Jeju Island by a local veterinary official on the 28th June in 1981. The specimen was examined at the institute of Veterinary Research in Anyang and was identified as *A. testudinarium*. The morphological characteristics of the male specimen were redescribed.

A total of 18 species of ticks belonging to 7 genera, such as, *Argas*, *Amblyomma*, *Boophilus*, *Dermacentor*, *Haemaphysalis*, *Hyalomma* and *Ixodes*, has now been recorded to occur in Korea.

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Amblyomma testudinarium 진드기의 國內發見記錄, 種屬同定 및 雄虫에 대한 形態學的 再記述

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抄 錄

인디아, 스리랑카, 버마, 타일랜드, 말레이지아, 인도차이나, 필리핀, 타이완 그리고 日本에 分布하는 것으로 이미 알려진 바 있는 *Amblyomma testudinarium* Kcoh, 1844 진드기가 今番에 우리 나라에서도 처음으로 發見 되었기에 報告한다.

濟州市로부터 東南方 24km 떨어진 地域인 북제주군 조천면 교래리에 位置하고 있는 대원牧場에서 飼育中인 홀스타인 乳牛로부터 採取된 未飽血 狀態의 雄虫 1마리를 檢查材料로하여 種屬同定을 하여 본 結果, *Amblyomma testudinarium* 진드기로 밝히어 졌으며, 이에 그 形態學的 特徵을 記述하여 報告한다.

硬진드기類에 屬하는 Amblyomma 진드기의 國內棲息이 確認됨에 따라, 國內에서 發見 報告된 진드기의 種類는 軟진드기인 Argas屬, 그리고 硬진드기인 Boophilus屬, Dermacentor屬, Haemaphysalis屬, Hyalomma屬, Ixodes屬 등, 軟진드기類 1屬, 硬진드기類 6屬, 都合 7屬 18種이 記錄 되었으며, 地理的으로 볼 때, *A. testudinarium* 진드기의 分布에 있어서 우리 나라가 東南亞細亞와 日本을 連結해 주는 橋梁的 位置에 놓여 있다는 點과 濟州道의 自然環境과 氣候條件은 熱帶 또는 亞熱帶 地域의 진드기 棲息에도 適合 할 것으로 思料된다.