

Morphological Characteristics of Normal and Gynandromorphic *Hyalomma asiaticum* Schulze and Schlottko, 1930

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Abstract: Gynandromorphic ticks are extremely rare, and often attract parasitologists' attention. During our examination of tick specimens, an engorged gynandromorph of *Hyalomma asiaticum* was noticed. This is the first record of gynandromorphic ticks from China. In this study, several important morphological structures of normal and gynandromorphic *H. asiaticum* were analyzed. Comparing to the normal *H. asiaticum*, the gynandromorphic specimen was a typical bipartite protogynander. Its right side showed normal female characteristics, whereas the left side had normal male traits. Different from other gynandromorphic ticks containing 1 anus, this tick reported here had 2 complete anuses, and the anus of the male part had a single adanal plate.

Key words: *Hyalomma asiaticum*, gynandromorphism, normal population

Gynandromorphs are chimeric individuals simultaneously possessing male and female characteristics. Unlike plants and some groups of animals, ticks are sexually dimorphic, and gynandromorphs are extremely rare (about 1/14,000 in adult ticks) [1,2]. More than 60 cases of gynandromorphism have been documented in the family Ixodidae, and 22 cases were in the genus *Hyalomma* [3-12]. Feldman-Muhsam [10] described 8 abnormalities in *Hyalomma savignyi*, 3 of which were somewhat gynandromorphs. One case was a laboratory-bred male showing a female spiracular plate on 1 side of the body, with the great reduction of anal and adanal shields, and the wanting of subanal shield. The second case was a pseudogynandromorph that the specimen was considered to a male tick, but the anterior part of its scutum exhibited female characteristics. The third is a female displayed both of the male and female features on 1 stigma. Clarke and Rechav [9] reported 3 cases of gynandromorphism in *Hyalomma truncatum*, all of which pre-

dominantly displayed female characteristics. Recently, a case of gynandromorphism in *Hyalomma marginatum* was reported by Keskin et al. [3]. The specimen displayed female features with some pieces of male conscutum in dorsal view, and displayed disorderly female and male features in ventral view. However, up to now, no gynandromorphic ticks have been reported in China.

Hyalomma asiaticum Schulze and Schlottko, 1930 is a common species in Asia, from Syria in the West to eastern China in the East [13]. Many adult ticks have been identified by many acarologists to date, but there have been few reports of gynandromorphism in the tick species of *H. asiaticum*. Only Campana-Rouget [14] reported gynandromorphic *H. asiaticum* briefly, but in the language of Russian. Additionally, the gynandromorphic specimen of *H. asiaticum* in this report contained some other particular morphological features which were not reported before.

H. asiaticum was collected from naturally infested sheep in Xinjiang province, Northwest China in 2011. Ticks were fed on the ears of rabbits according to the methods of Liu et al. [15]. Only 1 engorged gynandromorphic *H. asiaticum* was detected during a survey of our laboratory tick colony. The specimen was placed in a glass vial containing 75% ethanol and depos-

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Fig. 1. Normal *H. asiaticum*. (A) Dorsal view of a male. (B) Ventral view of a male; arrows point to the adanal plates. (C) Arrow points to the spiracular plate of a male. (D) Dorsal view of a female. (E) Ventral view of a female. (F) Arrow points to the spiracular plate of a female.

ited to the Tick Collection in Lanzhou Veterinary Research Institute, China.

In this case, compared to the male and female of normal *H. asiaticum* (Fig. 1), gynandromorphic specimen showed female characteristics on the right side, whereas exhibited male traits on the left side (Fig. 2A, B). Dorsally, the zig-zag line dividing the female and male areas into 2 halves could be distinguished running along the dorsal midline. The capitulum was divided equally, with a slightly longer palpus on the right side, in accordance with normal *H. asiaticum* females (Fig. 2C). The scutum of the specimen showed typical female morphologic characteristics on the right side and typical male morphologic characteristics on the left side.

Ventrally, the line separating male and female features was pushed over to the male side by the bulging female alloscutum, thus the female part was apparently dominant on the ventral surface of the specimen. As seen from Fig. 2D, 2 separate anuses were visible on the specimen, and found in the center of each sexual department, respectively. A single adanal plate (male characteristics) could be distinguished in the male side of gynandromorphic *H. asiaticum*. Male and female spiracular plate could be also distinguished in each sexual department (Fig. 2E, F). Dozens of eggs were laid by this tick; however, they were all small, dark and shriveled, and had not been hatched.

Like many other cases, the gynandromorphic specimen of this report contained both male and female parts, and divided equally in the dorsal view [4,14]. The sexual characteristics were typical in male and female side of this specimen. The part of female was much larger than that of the male in the ventral view. However, it was different from other gynandromorphic cases of ticks containing 1 anus, our case reported here had 2 complete anuses, and the anus of the male part had a single adanal plate.

It is worth mentioning that we have reared this tick species for 6 years since 2007, and updated the colony from field in 2011. Both of the colonies were reared under similar conditions to the nature. The gynandromorphic *H. asiaticum* described here is the only case, and all of the other ticks in our laboratory are normal. Thus, it is obvious that gynandromorphic *H. asiaticum* is rare, and this is also the first case of a gynandromorph in ticks from China. The description above also suggested that this kind of gynandromorphic case was not caused by laboratory conditions. Thus, to reveal the mechanism of formation of gynandromorphs in ticks, further researches should be carried out.

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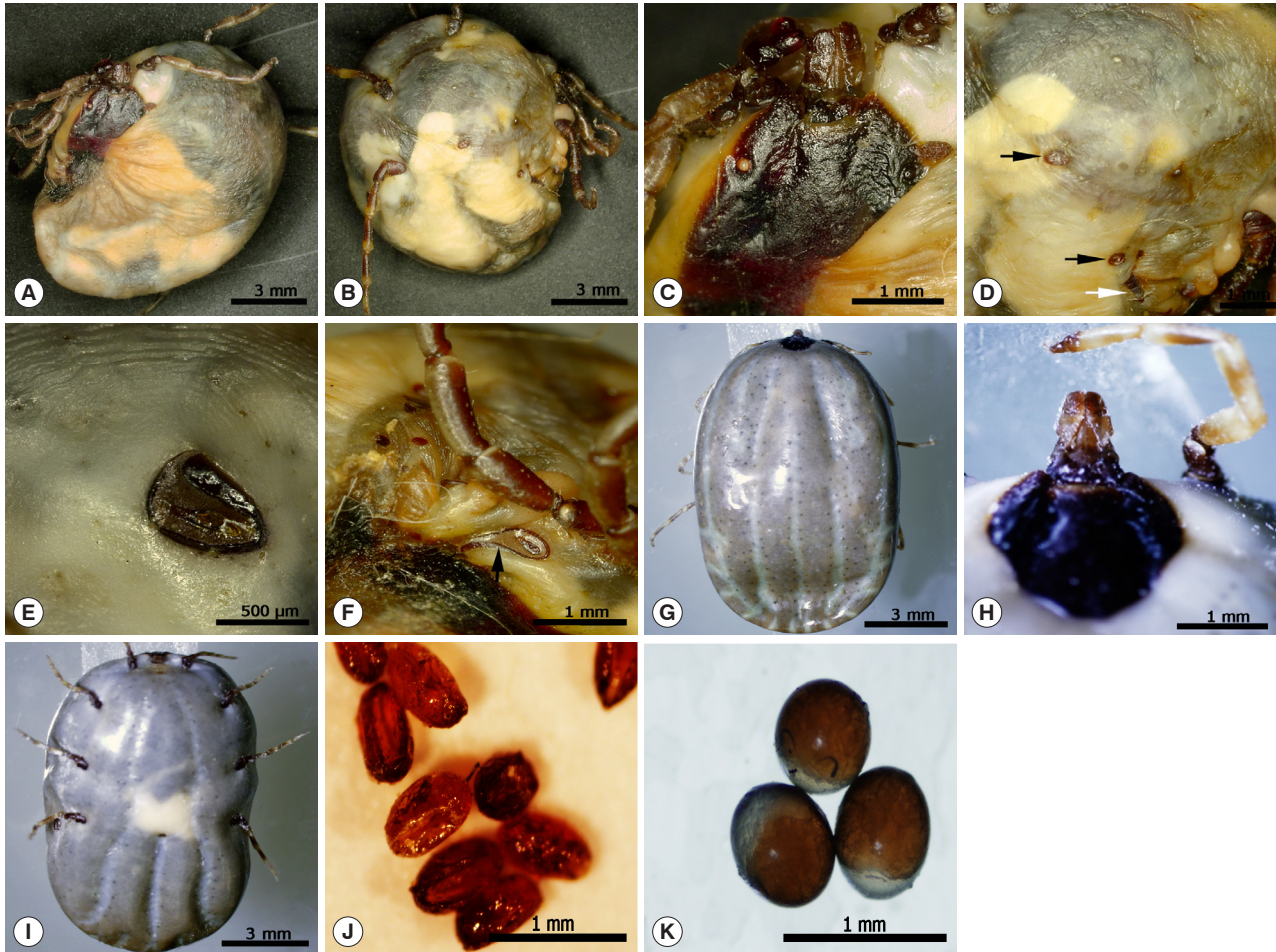


Fig. 2. Engorged gynandromorphic *H. asiaticum* (A-F) and normal female of *H. asiaticum* (G-I). (A) Dorsal view. (B) Ventral view. (C) Dorsal capitulum and scutum showing the differences between female and male sides. (D) Black arrows point to the 2 anal openings, and the white arrow points to the adanal plate of the male side. (E) Spiracular plate of the female side. (F) Arrow points to the spiracular plate of the male side. (G) Dorsal view. (H) Dorsal capitulum and scutum. (I) Ventral view. (J) Eggs of engorged gynandromorphic *H. asiaticum*. (K) Eggs of a normal female of *H. asiaticum*.

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CONFLICT OF INTEREST

We have no conflict of interest related to this work.

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