

The First Outbreak of *Chorioptes texanus* (Acari: Psoroptidae) Infestation in a Cattle Farm in Korea

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Abstract: Mites in the genus *Chorioptes* cause a mild form of skin disease in both domestic and wild ruminants. In July 2006, dermatitis characterized by alopecia, marked lichenification, accumulation of crust, and fissuring was recognized in 14 out of 200 Holstein dairy cattle raised in the cattle farm of the National Institute of Animal Science in Cheonan, Republic of Korea. Skin lesions were distributed mainly over the tail base, and sacral and perineal regions. Microscopic examinations of skin scraping samples from severely affected areas revealed numerous mites of all developmental stages. Morphologically, pedicels of the mites were short and unjointed. The tarsal suckers occurred on the pedicels of all the legs in the male worm and on the first, second, and fourth pair of legs in the adult female worm. A single long seta at the tarsus of legs III and the length of legs II being about twice as long as legs IV in adult male mites were observed. Arising anterior to the inner-most spatulate seta was a short seta with an average of $26.4 \pm 5.8 \mu\text{m}$ in length. Also, the length of setae #4 on the opisthosomal lobes was relatively short. Based on these observations, the mites were identified as *Chorioptes texanus*. Although the chorioptic mange may not influence the mortality rate in the affected farm, reports indicate that a decline in milk production can be observed. This is the first report of chorioptic infestation in a cattle farm from Korea.

Key words: *Chorioptes texanus*, mite infestation, cattle, Korea

INTRODUCTION

Chorioptic mange is a skin disease of both domestic and wild ruminants caused by *Chorioptes* spp. (Acari: Psoroptidae) which are obligatory, non-burrowing mites that pass all stages on the host [1]. It can cause irritation, localized dermatitis, and self-trauma due to pruritus, and is currently considered to be the most common form of cattle mange in many countries in the Northern Hemisphere. Sweatman [2,3] described two major species of *Chorioptes*, *C. bovis* (Hering, 1845) Gervais, 1859 and *C. texanus* Hirst, 1924, after detailed biologic and morphologic studies of the genus collected from many ungulates. Although numerous chorioptic species have been designated according to their hosts, the biological, morphological, and molecular genetic studies indicate that only *C. bovis* and *C. texanus* are distinctively valid species [4]. Morphologically, these two species differ in the shape and length of the opisthosomal setae of the

adult males [3]. The validity of 3 other species, *C. crewei* Lavoipierre, 1958, *C. mydaus* Fain, 1975, and *C. panda* Fain and Leclerc, 1975, is still regarded as questionable because discrimination of mites, which were described as isolated cases only, were based on morphological features while transfer or cross-breeding studies were not done [4]. A new pathogenic *Chorioptes* species that was morphologically and genetically distinct from previously reported species was recently reported to cause inflammation in the outer ear canals of moose (*Alces alces*) originated from Sweden [5].

C. bovis can cause lesions characterized by an exudative dermatitis on the lower legs and scrota of rams and has been stated that scrotal mange affects ram fertility [6]. However, chorioptic mites generally elicit a milder, superficial form of mange in cattle compared to severely pruritic mange caused by *Sarcoptes* spp. and *Psoroptes* spp. Chorioptic mites live on the surface of the skin feeding on epidermal material, but neither burrow into the skin nor pierce the skin [7]. While most *Chorioptes* spp. are rarely found in the ears of the hosts, *C. texanus* was considered to be a primarily auricular mite in reindeers (*Rangifer tarandus*) [3].

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Within the Southeast Asian countries, both *C. bovis* and *C. texanus* have been reported to infest dairy and beef cattle in Japan [8], and *C. bovis* in a wild Japanese serow [9]. *C. texanus* was also observed in goats from Malaysia [10]. However, their presence in Korea has never been reported. Herein, we report an outbreak of dermatitis in a cattle reproduction farm in Korea caused by *C. texanus* with a description of a minor discrepancy in morphological features compared to those of previous reports.

CASE RECORD

In July 2006, dermatitis characterized by alopecia, marked lichenification, accumulation of crust, and fissuring was recognized in 14 out of 200 Holstein dairy cattle raised in the cattle farm of the National Institute of Animal Science in Cheonan,



Fig. 1. Dermatitis of a Holstein cow showing crusts and heavy scabs in the ischio-rectal fossa due to *Chorioptes texanus* infestation.

Korea. Skin lesions were distributed over the tail base, sacral region, and areas of the hind udder. The body surface of the affected animals was characterized by alopecia, marked lichenification, accumulation of crust, and fissuring. Most seriously affected skin regions were up to 1 cm thick with cauliflower-like growth masses (Fig. 1).

For parasitological examination, skin scraping samples from severely affected areas were collected and fixed in 70% methanol. Mites in scrapings collected from the edges of active lesions were counted as described by Rehbein et al. [7]. Scrapings were made using a sharp spoon from an area approximately 3×3 cm, and 6 sites were scraped on each animal. Mites were extracted from these samples and mounted on slides with Down's PVA solution [11]. Diagnosis of the mites to the genus *Chorioptes* was made according to the key provided by Fain [12], and the differentiation of species was based on a key given by Fain and Leclerc [13]. The length of opisthosomal setae 1, 2, and 3 located at the posterior end of the opisthosomal lobes, seta 4 from the caudal body margin between the opisthosomal lobe and the 4th leg, and seta 5 located at tarsus III, were measured in 20 adult male mites (seta numbering according to Sweatman [3]).

Microscopic examination of scrapings revealed various stages of parasitic mites from 10 out of 14 affected animals (71.4%). The number of mites collected varied from 1 to 5,237 with an average of 1,007.2 mites per animal (data not shown). Body parts of 20 mites of each life stage, i.e., adult male, adult female, nymph male, nymph female, larva, and egg, were measured using an ocular micrometer. The protonymph and deutonymph stages of male and female mites were not differentiated in the

Table 1. Measurements of each life stage of *Chorioptes texanus* from the Holstein cattle from Korea

	Egg	Larva	Nymph ^a		Adult	
			Male	Female	Male	Female
Length	166.0 ± 12.9 (150-190)	180.8 ± 15.5 (150-210)	232.0 ± 38.5 (170-295)	231.1 ± 36.1 (173-310)	239.0 ± 14.6 (220-265)	373.5 ± 32.7 (325-440)
Width	88.5 ± 14.0 (65-110)	124.5 ± 13.9 (100-155)	169.8 ± 22.4 (133-205)	181.3 ± 25.5 (135-240)	198.8 ± 8.4 (185-220)	239.6 ± 42.4 (113-300)
Dorsum length	-	142.3 ± 19.2 (105-170)	190.9 ± 35.7 (135-250)	190.0 ± 33.1 (138-270)	191.1 ± 13.3 (175-213)	315.5 ± 34.2 (255-380)
Propodosomal plate length	-	47.4 ± 12.8 (33-90)	50.0 ± 6.0 (38-63)	53.1 ± 8.1 (38-68)	58.3 ± 8.5 (40-70)	82.1 ± 5.9 (70-90)
Propodosomal plate width	-	39.4 ± 6.2 (30-55)	53.9 ± 6.8 (38-65)	57.6 ± 5.9 (48-68)	61.5 ± 7.0 (48-73)	80.3 ± 5.8 (68-90)
Gnathosoma width	-	38.0 ± 5.4 (30-48)	48.5 ± 5.0 (38-58)	50.1 ± 5.0 (43-60)	53.5 ± 3.1 (50-63)	71.4 ± 7.1 (63-80)

All data are shown in micrometers as means followed by SD and ranges in parentheses.

^aProtonymph and deutonymph were measured together.

measurement of the nymphal stages. Measurements of body parts in each life stage are shown in Table 1. Comparative lengths of setae on adult male mites collected from the Holstein cattle in this study with those of male mites reported by Sweatman [3] and Hestvik et al. [5] are provided in Table 2.

All developmental stages of mites, from the egg to adult stages, were observed from samples collected from affected cattle (Fig. 2). Morphologically, pedicels of the mites were short and un-

jointed. Tarsal suckers occurred on the pedicels of all legs in the adult male and on the first, second, and fourth pair of legs in the adult female. A single long seta at the tarsus of legs III and the length of legs II being about twice as long as legs IV in adult male mites were observed. Based on these observations, the mites were identified as the genus *Chorioptes*.

The adult males had 2 prominent abdominal lobes on the posterior end. The opisthosomal lobes were as long as wide,

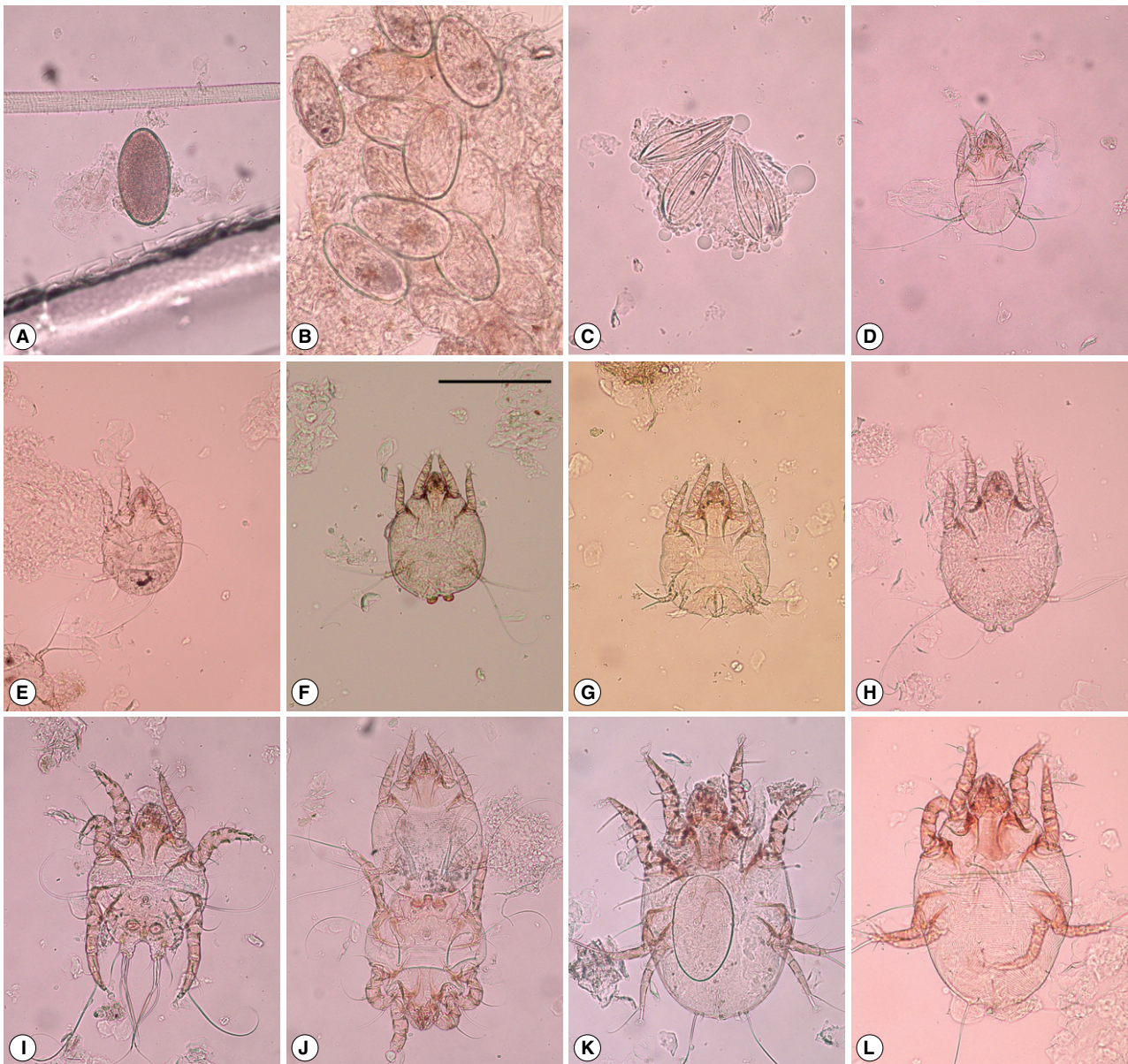


Fig. 2. Light micrographs of various developmental stages of *Chorioptes texanus*. (A) Unembryonated egg. (B) Numerous eggs, each containing a fully developed larva. (C) Empty egg shells. (D) Ventral view of a larvae (no sexual dimorphism). (E) Dorsal view of a male protonymph. (F) Dorsal view of a female protonymph. (G) Ventral view of a male deutonymph. (H) Dorsal view of a pubescent female (= female deutonymph). (I) Ventral view of an adult male. (J) An attachment pair. Pubescent female above and adult male below. (K) Ventral view of an ovigerous female (= adult female) containing an egg. (L) Dorsal view of an adult female. Bar = 200 μ m

and bore 5 setae. In the center of the posterior end of the lobe bore 3 long setae with 1 in the center the longest ($213.0 \pm 15.1 \mu\text{m}$), whereas the other 2 were identical in length (setae #2 in Fig. 3, $172.3 \pm 8.9 \mu\text{m}$) and were spatulated in shape at the distal end. The outer spatulate seta did not have the conspicuous hook towards the proximal end which was a characteristic feature of *C. bovis* [3]. Each opisthosomal lobe had a primary lobe with an outer, smaller accessory lobe forming a small angle with relation to the main lobe. The accessory lobe gave rise to a short, fine seta (seta #1 in Fig. 3) with an average length of $61.1 \pm 8.0 \mu\text{m}$ from the outer corner of the opisthosomal lobe on the same plane as the prominent spatulated setae (setae #2 in

Fig. 3).

Arising just anterior to the innermost spatulate seta was a short seta (seta #3, $26.4 \pm 5.8 \mu\text{m}$) which was a characteristic feature of *C. texanus*. Its counterpart in *C. bovis* was 4 times longer and arises more anteriorly [3]. Lateral to the opisthosomal lobes, the dorsum ended posteriorly in a small, but distinct point. Arising just outside from the point was a short seta ($26.6 \pm 4.8 \mu\text{m}$, setae #4 in Fig. 2) which was also a different feature compared to that of *C. bovis* in which the corresponding seta was close to 3 times longer. The single ventral seta of tarsus III was short and measured $20.3 \pm 7.5 \mu\text{m}$ (setae #5 in Fig. 2). These data together indicated that the mites infested on the Holstein cattle in this report were *C. texanus* according to the description of Sweatman [3].

Contrary to the shape of the elongated propodosomal plate

Table 2. Comparative length of setae on adult male mites of *Chorioptes texanus* from the Holstein cattle in Korea

Setal No.	Setal length (μm)				
	1	2	3	4	5
<i>C. texanus</i> from Canadian reindeer [3]					
Range	66-98	193-235	27-39	23-27	14-29
Mean	80	216	31	25	18
SD	7.5	10.2	2.9	1.4	3.3
N	20	20	20	20	20
<i>C. texanus</i> from Sweden cattle [5]					
Range	37-69	145-185	13-32	16-32	8-40
Mean	54.2	164	24.3	24.9	18.3
SD	7.3	8	5.4	3.9	7.2
N	40	40	31	38	35
<i>C. texanus</i> from Korean cattle [this study]					
Range	35-75	160-200	15-37.5	17.5-35	7.5-40
Mean	61.1	172.3	26.4	26.6	20.3
SD	8	8.9	5.8	4.8	7.5
N	20	20	20	20	20

N: number of measurements, SD: standard deviation.
The numbers of each seta correspond to the setae marked in Fig. 3.

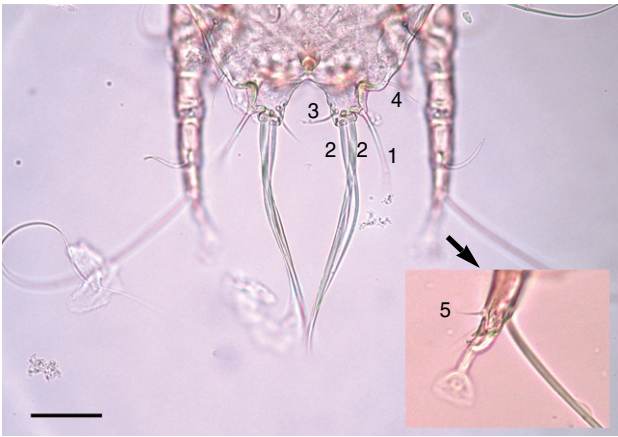


Fig. 3. Light micrograph of an adult male *Chorioptes texanus* sampled from Holstein cattle in Korea, showing the caudal end with opisthosomal lobes. Measurements for the numbered setae are presented in Table 2. Seta numbering according to Sweatman [3]. Bar = $50 \mu\text{m}$.

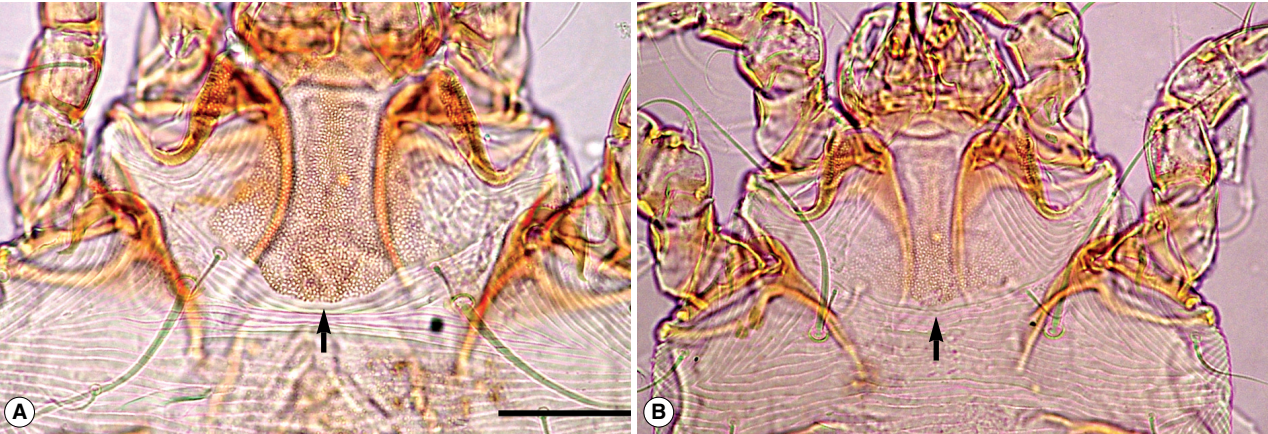


Fig. 4. Propodosomal plates of *Chorioptes texanus*; (A) adult female, (B) adult male. Bar = $100 \mu\text{m}$.

of *C. bovis* reported by Shibata et al. [9] and Sweatman [2], the length and width of the propodosomal plate of all developmental stages in this report were similar in length which measured $82.1 \times 80.3 \mu\text{m}$ in adult female and $58.3 \times 61.5 \mu\text{m}$ in adult male (Table 1). Furthermore, while Sweatman [2] recorded that the propodosomal plate of adult male was often pointed posteriorly, such features was not observed in *C. texanus* in this report. The projection pattern of the posterior base line of the propodosomal plates in both male and female adult mites was rather broad than pointed in the center (Fig. 4).

DISCUSSION

C. texanus has so far been isolated from both domestic and wildlife animals including goats in Texas, reindeer in Canada, cattle in Brazil, Israel, Germany, and USA, and elks in Poland [4]. In the Southeast Asian countries, *C. texanus* has been reported to infest cattle and goats from Japan [8] and Malaysia [10], respectively.

C. texanus isolated from the Holstein cattle from Korea in this report was morphologically identical to *C. texanus* reported by Sweatman [2] except for the shape of the propodosomal plates of adult female and adult male mites. Contrary to the pointed propodosomal plate posteriorly described by Sweatman, the length and width of the propodosomal plate of *C. texanus* isolated from the Holstein cattle from Korea was similar. This morphological difference, however, does not appear to be significant enough to separate into a new species.

The taxonomic status of *C. texanus* is based on the morphological characteristics of male mites which differ from *C. bovis* by the opisthosomal lobes and their setae. Male mites of *C. texanus* have paired opisthosomal lobes, each consisting of a primary lobe with an outer, smaller secondary lobe, whereas *C. bovis* has undivided lobes. Furthermore, while the spatulate setae of *C. texanus* are almost twice as long as those of *C. bovis*, the fine seta at the outer corner of each opisthosomal lobe in *C. texanus* is distinctly shorter than its counterpart in *C. bovis* which contrasted with 4 times longer, thick seta in the same position [3]. While the outer spatulate seta of *C. bovis* has a conspicuous hook towards the proximal end, it is absent on *C. texanus*. Sweatman's bipartite classification of the genus *Chorioptes* was confirmed genetically by Essig et al. [14] who characterized the second internal transcribed spacer of the rRNA gene extracted from 14 isolates of *Chorioptes* spp. using primers RIB-4 and RIB-3. Although 3 additional *Chorioptes* spp., *C. crewei* Lavoipierre,

1958, *C. mydaus* Fain, 1975, and *C. panda* Fain and Leclerc, 1875, were described after Sweatman's revision in 1957, their validity is considered questionable, because features used for discriminating these taxons were not convincing and no transfer or cross-breeding studies were done [4]. Recently Hestvik et al. [5] reported a previously unidentified *Chorioptes* species infesting the outer ear canals of the moose (*Alces alces*) which differ morphologically and genetically from other *Chorioptes* species.

C. bovis has been reported to infest the feet of horses, sheep, and goats in the Netherlands [15], and in a wild Japanese serow [9]. *C. texanus* has been found on the body of domestic goats in Texas [16], the ears of reindeers (*Rangifer tarandi*) [3] in Canada, cattle in Brazil [17], Israel [1,14,18], Germany, and USA [14], gazelles (*Gazella gazelle*) in Israel [1], and from elks (*Alces alces*) in Poland [19,20]. These indicate that both *C. bovis* and *C. texanus* have a broad host range.

Unlike skin diseases of cattle caused by *Sarcoptes* and *Psoroptes* mites, the chorioptic mange generally elicits milder symptoms probably because chorioptic mites neither burrow nor pierce the skin. Cases of herd infections frequently occur during winter season, and are typically observed in the adult age group, especially in milking-age cows. Clinical signs include crusty lesions in the root of the tail and the grooves on either side, and tend to be localized with moderate pruritus present. Initially starting with a varnished surface, later the affected area is covered with fine, dry scales which can spread towards the perineum, escutcheon, inner sides of the thighs, and fetlocks [7]. Irritation and itching become intense when lesions extend in size and coalesce to form crusts and heavy scabs that can spread even to the sacral region and the udder. Although the Chorioptic mange may not influence the affected farm economically, reports indicate that a decline in milk production can be observed [21].

Since this is the first report of chorioptic mite infestation in Korea, we propose the Korean name of the genus *Chorioptes* as Pibujindeugi and as Texaspibujindeugi for the Korean name of the species *C. texanus*. We also propose the Korean name for *C. bovis* as Sopibujindeugi.

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