

Is *Chorioptes texanus* to Displace *Chorioptes bovis*? Notes on the Mites Causing Bovine Chorioptic Mange in Central Europe

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Abstract: Chorioptic mange is the most common type of bovine mange in central Europe, affecting mainly housed dairy cattle. Until 1976, when *Chorioptes texanus* were described for the first time from mangy cattle in Brazil, bovine chorioptic mange was thought to be caused only by *C. bovis* mites. In Europe, *C. texanus* parasitism in cattle was for the first time reported in Germany in 1998. Following the repeated diagnosis of *C. texanus* mites in skin scrapings from local cattle in recent years, scrapings from cattle that were clinically suspicious for chorioptic mange were requested and provided during the years from 2019 to 2022 from Austria, France, Germany, and Switzerland (from 6, 17, 28, and 7 farms, respectively) and from dairy cows of 1 farm in Canada. Mites were isolated from the scrapings, cleared, and microscopically identified based on their morphology. Examination of scrapings revealed the presence of *C. texanus* in the cattle from 2 farms in Austria, 13 farms in France, 7 farms in Germany, 1 farm in Switzerland, and in the specimens from Canada. *Chorioptes bovis* mites were recovered only in scrapings from 5 farms in Germany and *Psoroptes ovis* mites in scrapings of cattle from 2 farms in France. The scrapings did not reveal co-infestations of *C. bovis* and *C. texanus* or of *Chorioptes* species and *P. ovis*. The records of *C. texanus* from Austria, France, Switzerland, and Canada constitute the first descriptions of this mite species in these countries. Although this investigation was based on an opportunistic collection of the material and was of small extent, the results suggest a widespread occurrence of *C. texanus* in central Europe and may emphasize the need for studies to closely investigate the nature of the causative agents of chorioptic mange in cattle and other hosts.



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1. Introduction

Chorioptes mites (Acari, Psoroptidae) are obligatory, permanent ectoparasites of a wide range of domesticated and wild ungulates, but also of carnivores (ursids and stink badgers). *Chorioptes* species are non-burrowing mites causing chorioptic mange [1].

In cattle, chorioptic mange constitutes the most prevalent form of mange in the majority of countries in temperate regions. In contrast to bovine mange caused by infestation with *Sarcoptes* and *Psoroptes* mites, chorioptic mange is generally considered to be a less pathogenic, milder dermatitis of superficial character. The lesions are usually restricted in size and associated with the root of the tail (tail head) and the grooves on either side (caudal folds); however, they may spread towards the perineum, escutcheon, thighs, and lower legs (Figure 1), and even cases of generalization have been reported. Irritation and itching are present and may become intense, especially on palpation of the lesions. Chorioptic mange is mainly observed in milking-age cows and, although potentially present year-round under indoor-housing management systems, the condition is generally highly seasonal and most prevalent during the winter housing period. There are different opinions about the impact of chorioptic mange on cattle given the high variability in the clinical presentation and the difficulties to quantify negative effects on performance in adult animals. However, a generally higher level of restlessness, especially during the milking process, or an increase

in activities to relieve pruritus associated with mange, constitute long-term stressors which reduce the well-being of the animals and can contribute to productivity losses [2–7].



Figure 1. Chorioptic mange lesions associated with the grooves (caudal folds) on the sides of the root of the tail (**left** picture) or the escutcheon and thighs (**right** picture) of dairy cows.

The taxonomy of the genus *Chorioptes* has been repeatedly a matter of debate in the recent past [8–10]. The most recent revision concluded that there are six valid species including *C. bovis* (Hering, 1845) and *C. texanus* Hirst, 1924 which are the causative agents of chorioptic mange in bovines and other ungulates [1]. Until 1976, when *C. texanus* were described for the first time from mangy cattle in Brazil [11], bovine chorioptic mange was thought to be caused exclusively by *C. bovis* mites. In Europe, *C. texanus* mite parasitism on cattle was for the first time reported in 1998 from Germany [12] and later again by [10]. No other records of *C. texanus* from cattle have been published from Europe apart from a notice in a paper from Iceland which mentioned the observation of *C. texanus* on cattle from Norway [13].

Following the repeated diagnosis of *C. texanus* mites in scrapings from cattle kept in farms in the vicinity of our laboratory in recent years, we were interested in getting a better understanding of the nature of the agents causing bovine chorioptic mange and examined scrapings from cattle with lesions suspicious for mange collected in Germany and neighboring countries.

2. Material and Methods

2.1. Source of Material

Local practitioners, veterinarians of animal health services, veterinary parasitologists, and the Boehringer Ingelheim technical services group were asked for the submission of skin scrapings from cattle with lesions clinically suspicious for chorioptic mange (one scraping per animal, scrapings of up to five animals per farm) accompanied by information on the locations of the farms and the breeds of the cattle. In addition, the authors of a recently published paper on the behavior of cows with chorioptic mange on a dairy farm in British Columbia, Canada [5], provided skin scrapings for the speciation of the mites.

2.2. Examination of Skin Scrapings for Ectoparasites

The skin specimens were examined for ectoparasites with the standard methodology. Native examination of the material was followed by maceration in a gently heated (~70 °C) 10% potassium hydroxide solution. A dissection microscope (Leica M205C; Leica Microsystems GmbH, Wetzlar, Germany) was used for both the examination of the native scraping material and the digest and the recovery of the ectoparasites.

Identification of the isolated ectoparasites (lice and mites), including *Chorioptes* mites to genus, was made according to Sweatman [14] and Hiepe and Ribbeck [15]. Differentiation of the *Chorioptes* mites to species was based on the examination of the opisthosomal setae (setae length ratios and shape) associated with the opisthosomal lobes of adult male mites (Figure 2) using a binocular light microscope (Leica DM2500; Leica Microsystems GmbH, Wetzlar, Germany) which are the primary morphological characters used to identify *Chorioptes* species from ungulates [10].



Figure 2. *Chorioptes bovis* (left picture) and *C. texanus* (right picture) male mites (ventral view).

3. Results

During the years from 2019 to 2022, a total of 246 skin scrapings from cattle from 58 farms in Austria, France, Germany, and Switzerland, and one scraping each from three cows from the farm in Canada, were received and examined.

The examination of the skin specimens yielded the following results:

Austria: 33 scrapings from 6 farms (3 to 5 scrapings per farm): *C. texanus*, 2 farms; *Bovicola bovis*, 2 farms; *Haematopinus eurysternus*, 2 farms.

France: 80 scrapings from 17 farms (2 to 5 scrapings per farm): *C. texanus*, 13 farms; *Chorioptes* spp. (no male mites isolated), 1 farm; *Psoroptes ovis*, 2 farms; *B. bovis*, 5 farms; *H. eurysternus*, 2 farms; *Linognathus vituli*, 1 farm.

Germany: 114 scrapings from 28 farms (1 to 5 scrapings per farm): *C. texanus*, 7 farms; *C. bovis*, 5 farms; *B. bovis*, 2 farms; *H. eurysternus*, 3 farms; *L. vituli*, 2 farms.

Switzerland: 19 scrapings from 7 farms (1 to 5 scrapings per farm): *C. texanus*, 1 farm.

Canada: 3 scrapings from 1 farm: *C. texanus*.

The examination of the scrapings did not reveal co-infestations of *C. bovis* and *C. texanus* or of *Chorioptes* species mites and *P. ovis*, or the concurrent presence of the two *Chorioptes* species on one and the same farm; however, lice were occasionally observed in scrapings with *Chorioptes* mites.

Figure 3 shows the geographic localization of the farms with *C. texanus* and *C. bovis* records in Europe. *Chorioptes texanus*-positive cattle were recorded on farms in Austria in the federal state of Upper Austria; in Germany in the federal states of Bavaria, North Rhine-Westphalia, Saxony, and Thuringia; in France in the regions Bretagne, Normandy, and Pays de la Loire; and in Switzerland in the Canton of Friborg.

The breeds of cattle diagnosed as *C. texanus*-positive in this investigation are included in Table 1 which provides a listing of the records of *C. texanus* in cattle worldwide.

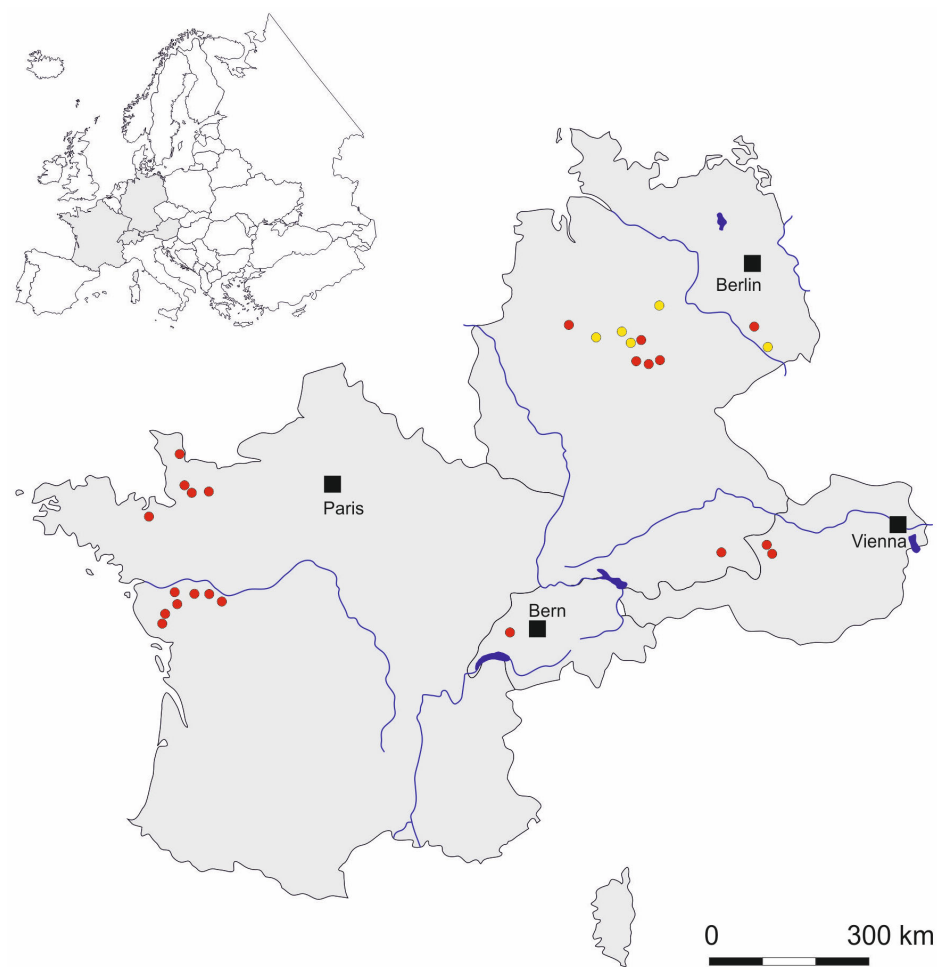


Figure 3. Localization of the farms with cattle testing positive for *Chorioptes texanus* (red dots) and *C. bovis* (yellow dots) in Austria, France, Germany, and Switzerland.

Table 1. Countries of record and breeds of cattle infested with *Chorioptes texanus*.

Country	Breeds of Cattle Diagnosed <i>Chorioptes texanus</i> -Infested	Reference(s)
Austria	Holstein-Friesian ¹ , (Austrian) Simmental	This study
France	Holstein-Friesian, Normande	This study
Germany	No information provided	[8,10,12]
	Holstein-Friesian, (German) Simmental	This study
Norway	Norwegian Red	[13], B.K. Gjerde (in litt., 07 and 24 January 2022) ²
Russia	Holstein-Friesian	[16]
Switzerland	Brown Swiss	This study
China	Holstein-Friesian, Montbeliarde, Simmental, Chinese native cattle	[17,18]
	No information provided	[19,20]
Israel	Holstein-Friesian, Charolais	[21–25]
Japan	Holstein-Friesian, Japanese black	[4,26–32]
South Korea	Holstein-Friesian	[33,34]
Brazil	Holstein-Friesian, Zebu cattle	[11,35]
Canada	Holstein-Friesian	This study
USA	No information provided	[1,8,12,36]

¹ ‘Holstein-Friesian’ refers to the most widespread breed type of dairy cattle in the world, often referred to as Holstein or Friesian only or ‘Black-pied’. ² *Chorioptes texanus* were identified in Norway in 2001 from “in all likelihood . . . dairy cows of the Norwegian Red breed”; identification was based on the morphology of adult male mites (opisthosomal lobes and setae).

4. Discussion

The question of which species of mites of the genus *Chorioptes* are the causative agents of bovine chorioptic mange in a region is of importance to help make a correct diagnosis of the parasites and to understand the epidemiology of this parasitic condition. In addition, it may have implications for the potential for cross-transmission between different host species and for the implementation of control measures.

Any interpretation of the results of the present investigation needs to consider the type of sampling and the rather limited extent, such that no conclusion can be made on the prevalence of *C. texanus* and *C. bovis* in cattle in central Europe. However, the findings indicate that *C. texanus* may currently be a common agent of chorioptic mange in cattle in central Europe beside *C. bovis*. It is not clear for how long *C. texanus* have been present and infesting cattle in Europe. When discussing the unexpected finding of exclusively *C. texanus* mites in the scrapings collected from cattle in Germany for their study, Essig et al. [8] expressed the opinion that many chorioptic mite isolates may previously have simply (“... stereotypically ...”) been designated to *C. bovis* because no other species of *Chorioptes* was expected to infest cattle and to cause chorioptic mange and the mites were thus not thoroughly examined. This assumption may be kept in mind at least for more recent reports on bovine *C. bovis* mange which did not mention a species-level identification based on microscopy of adult male mites or did not take *C. texanus* as a parasite of cattle into account.

Based on records from 7 of the 16 federal states in Germany—Essig et al. [8]: Baden-Württemberg, Bavaria, Brandenburg, and Schleswig-Holstein; present study: Bavaria, North Rhine-Westphalia, Saxony, and Thuringia—a wide geographic distribution of *C. texanus* in the cattle population of the country can be assumed. Conversely to the work of Essig et al. [8], this investigation confirmed the presence of *C. bovis* in cattle in Germany with records from the federal states of Hesse, Saxony, Saxony-Anhalt, and Thuringia.

To the knowledge of the authors, the findings of *C. texanus* on cattle from Austria, France, Switzerland, and Canada constitute the first descriptions of this species in these countries and add to the number of countries with records of *C. texanus* as a causative agent of bovine chorioptic mange (Table 1). Although expected to occur on cattle in the UK [37], there are no surveys which have confirmed the presence of *C. texanus* in the UK (R. Wall, in litt., 15 February 2021).

The examination of skin scrapings in the present investigation did not identify cases of mixed infestation with *C. texanus* and *C. bovis* on the same animal. However, co-infestation with both species of mites in cattle has been reported several times from Japan [29–32].

The range of breeds of cattle from which *C. texanus* were isolated indicates that various cattle breeds are susceptible to the infestation (Table 1). The apparent predominance of Holstein-Friesian cattle likely reflects that this breed represents the most important dairy breed worldwide and that Holstein-Friesian cattle are subject to extensive international trade.

Chorioptes texanus, which was described in 1924 based on mites collected from a domestic goat in Texas, USA, were recognized on cattle for the first time in a brief report from Brazil in 1976 [11]. However, mites collected from cattle in Israel and Japan in 1960 and 1972, respectively, and originally assigned to be *C. bovis*, were identified as *C. texanus* upon re-examination [25,38]. Since the report of *C. texanus* on cattle in Brazil from 1976, *C. texanus* have been reported as the causative agent of bovine chorioptic mange several times in various countries in Asia, Europe, and the Americas (Table 1). Based on unpublished observations by the US Department of Agriculture, it was assumed that “*C. texanus* may now be the prevalent *Chorioptes* species on cattle in the USA” [36]. In Japan, where *C. texanus* on cattle were first reported in 1991 [26,39], studies conducted since then have shown that, although both *C. bovis* and *C. texanus* are present in the cattle population, infestation with *C. texanus* is more frequently observed in the more recent studies [31].

No difference in the clinical consequence of the infestation of cattle with *C. bovis* or *C. texanus* is expected [37]. In addition, controlled studies conducted worldwide to evaluate the efficacy of the pour-on administration of ivermectin and eprinomectin products in cattle with chorioptic mange consistently demonstrated a high efficacy of the products

and did not indicate any difference in the response to the treatments between *C. bovis* and *C. texanus* [2,4,29,34,40–42].

Apart from causing mange in cattle, *C. texanus* mites have been identified as parasites of goats in Texas, USA [43,44], Java, Indonesia [45]; putatively, as per Hirst [44] and von Maydell [46]), Malaysia [47], and India [48]; of sheep in Brazil [49]; and of Formosan serows (*Capricornis swinhoei*) from Taiwan [50]. Interestingly, all records of *C. texanus* in non-bovine hosts were exclusively made in warmer climate regions while *C. texanus* infestation of cattle was reported from both regions with warmer climate (Brazil; Israel; southern China; South Korea; southern prefectures of Japan) and temperate regions (British Columbia, Canada; Wisconsin, USA; Austria; France; Germany; Switzerland; Norway; Moscow region, Russia; Hokkaido and Yamagata prefectures, Japan) (Table 1).

In Canada, mites isolated from the ears of semi-domesticated reindeer (*Rangifer tarandus*) have been described as *C. texanus* in the past [14]. However, recently conducted studies of mites collected from the outer ear canal of moose (*Alces alces*) from Scandinavia and Russia concluded that the mites described as *C. texanus* by Sweatman [14] were most likely mites of the newly described species *C. sweatmani* Bochkov, Klimov, Hestvik and Saveljev, 2014, which is closely related to *C. texanus* [1,10,51]. In this context, it is worth mentioning that, similarly, mites isolated from the body surface of clinically unsuspicious wild cervids (moose; fallow deer [*Dama dama*]; sika deer [*Cervus nippon*]) in Poland and described as *C. texanus* [52–56] were discussed as potentially representing *C. sweatmani* [1].

Although conducted on an opportunistic basis and of small extent, the work presented here provides the most up-to-date information on *C. texanus* and *C. bovis* occurrence in Germany and reports the first records of the species *C. texanus* in cattle from Austria, Canada, France, and Switzerland. The results of this work suggest a widespread occurrence of *C. texanus* in central Europe and put the role of *C. bovis*, which was thought to be the prevalent agent of bovine chorioptic mange in the past, in question. Further studies on the causative agents of bovine chorioptic mange in Europe, on the potential role of *C. texanus* as a parasite of sheep and goats, as well as on the host specificity of the species, are desired.

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References

1. Bochkov, A.V.; Klimov, P.B.; Hestvik, G.; Saveljev, A.P. Integrated Bayesian species delimitation and morphological diagnostics of chorioptic mange mites (Acariformes: Psoroptidae: *Chorioptes*). *Parasitol. Res.* **2014**, *113*, 2803–2827. [CrossRef]
2. Rehbein, S.; Winter, R.; Visser, M.; Maciel, A.E.; Marley, S.E. Chorioptic mange in dairy cattle: Treatment with eprinomectin pour-on. *Parasitol. Res.* **2005**, *98*, 21–25. [CrossRef] [PubMed]
3. Rehbein, S.; Visser, M.; Rauh, R.; Trommer, B. *Chorioptes*-Räude des Rindes: Lokalisation der Hautveränderungen und resultierende Lederschäden. *Berl. Münch. Tierärztl. Wochenschr.* **2017**, *130*, 501–510.

4. Komatsu, K.; Matsumoto, J.; Kamikata, K. The efficacy of eprinomectin against bovine mange caused by naturally occurring infestation with *Chorioptes texanus*. *J. Jpn. Vet. Med. Assoc.* **2014**, *67*, 659–664. (In Japanese) [[CrossRef](#)]
5. Moncada, A.C.; Neave, H.W.; von Keyserlingk, M.A.G.; Weary, D.M. Use of a mechanical brush by dairy cows with chorioptic mange. *Appl. Anim. Behav. Sci.* **2020**, *223*, 104925. [[CrossRef](#)]
6. Forbes, A.B. *Parasites of Cattle and Sheep*; CABI: Wallingford, UK, 2021.
7. Yamane, Y.; Seo, T. Relationship between animal welfare score by the assessment system for dairy cattle and behavior of dairy cattle. *Nihon Chikusan Gakkaiho* **2022**, *93*, 211–223. (In Japanese) [[CrossRef](#)]
8. Essig, A.; Rinder, H.; Gothe, R.; Zahler, M. Genetic differentiation of mites of the genus *Chorioptes* (Acari: Psoroptidae). *Exp. Appl. Acarol.* **1999**, *23*, 309–318. [[CrossRef](#)] [[PubMed](#)]
9. Zahler, M.; Hendriks, W.M.L.; Essig, A.; Rinder, H.; Gothe, R. Taxonomic reconsideration of the genus *Chorioptes* Gervais and van Beneden, 1859 (Acari: Psoroptidae). *Exp. Appl. Acarol.* **2001**, *25*, 517–523. [[CrossRef](#)] [[PubMed](#)]
10. Lusat, J.; Bornstein, S.; Wall, R. *Chorioptes* mites: Re-evaluation of species integrity. *Med. Vet. Entomol.* **2010**, *163*, 179–184. [[CrossRef](#)]
11. Faccini, J.L.H.; Massard, C.L. O gênero *Chorioptes* Gervais, 1895 [sic], parasita de ruminantes no Brasil (Psoroptidae, Acarina). *Rev. Brasil. Biol.* **1976**, *36*, 871–872.
12. Essig, A.S. Molekularbiologische Untersuchungen zur Taxonomie von Räude milben der Gattungen *Chorioptes* und *Psoroptes* (Acari: Psoroptidae). Ph.D. Thesis, Ludwig-Maximilians-Universität, Munich, Germany, 1998.
13. Eydal, M.; Richter, S.H. Lice and mite infestations of cattle in Iceland. *Icel. Agric. Sci.* **2010**, *23*, 87–95.
14. Sweatman, G.K. Redescription of *Chorioptes texanus*, a parasitic mite from the ears of reindeer in the Canadian arctic. *Can. J. Zool.* **1958**, *36*, 391–397. [[CrossRef](#)]
15. Hiepe, T.; Ribbeck, R. *Lehrbuch der Parasitologie. Veterinärmedizinische Arachno-Entomologie*; Gustav Fischer Verlag: Jena, Germany, 1982.
16. Puzanova, E.V. Morfologičeskie Osobennosti Klešej roda *Chorioptes*, Soveršenstvovanie Diagnostiki i mer Bor“by. Kand Biol Nauk. Ph.D. Thesis, Moskovsk. Gosudarstvenn, Akad. Vet. Med. Biotechnol. K.I. Skrâbina, Moskva, Rossiâ, 2013. (In Russian).
17. Wang, S.; Gu, X.; Fu, Y.; Lai, A.; Wang, S.; Peng, X.; Yang, G. Molecular taxonomic relationships of *Psoroptes* and *Chorioptes* mites from China based on COI and 18S rDNA gene sequences. *Vet. Parasitol.* **2012**, *184*, 392–397. [[CrossRef](#)] [[PubMed](#)]
18. Juan, C.; ChengCheng, L.; Yae, Z.; Li, H.; YuanJun, Y.; Fan, Y.; ZhiYun, S. Population identification and divergence threshold in Psoroptidae based on ribosomal ITS2 and mitochondrial COI genes. *Parasitol. Res.* **2015**, *114*, 3497–3507. [[CrossRef](#)]
19. Nong, X.; Li, S.-H.; Wang, J.-H.; Xie, Y.; Chen, X.-B.; Peng, X.-R.; Yang, G.-Y. Acaricidal activity of petroleum ether extracts from *Eupatorium adenophorum* against the ectoparasitic cattle mite, *Chorioptes texanus*. *Parasitol. Res.* **2014**, *113*, 1201–1207. [[CrossRef](#)] [[PubMed](#)]
20. He, R.; Gu, X.-B.; Xie, Y.; Peng, X.-R.; Angel, C.; Yang, G.-Y. Transcriptome-based analysis of putative allergens of *Chorioptes texanus*. *Parasites Vectors* **2019**, *12*, 587. [[CrossRef](#)] [[PubMed](#)]
21. Yeruham, I.; Hadani, A.; Sklar, A.; Monbaz, A. The occurrence of chorioptic mange in dairy cattle in Israel. *Refuah Vet.* **1981**, *38*, 176–179.
22. Yeruham, I.; Rosen, S.; Hadani, A. *Chorioptes texanus* (Psoroptidae Hirst, 1924) causing mange in cattle in Israel. *Israel J. Vet. Med.* **1992**, *47*, 120–123.
23. Yeruham, I.; Rosen, S.; Hadani, A. Chorioptic mange (Acarina: Psoroptidae) in domestic and wild ruminants in Israel. *Exp. Appl. Acarol.* **1999**, *23*, 861–869. [[CrossRef](#)]
24. Yeruham, I.; Elad, D.; Perl, S. Economic aspects of outbreaks of dermatophilosis in first-calving cows in nine herds of dairy cattle in Israel. *Vet. Rec.* **2000**, *146*, 695–698. [[CrossRef](#)]
25. Rosen, S.; Yeruham, I.; Hadani, A. *Chorioptes texanus* (Hirst, 1924), Psoroptidae on cattle in Israel. *Acarologia* **1989**, *30*, 373–376.
26. Takeuchi, K.; Oku, Y.; Kusakari, N.; Kubota, G.; Matsuguchi, Y. On mange in Holstein cows caused by *Chorioptes texanus*. *J. Hokkaido Vet. Med. Assoc.* **1991**, *35*, 50. (In Japanese)
27. Takeuchi, K.; Kusakari, N.; Kubota, M.; Matsuguchi, Y.; Oku, Y.; Playford, M.C. Mange mite infestation on Holstein dairy cows caused by *Chorioptes texanus*. *J. Hokkaido Vet. Med. Assoc.* **1992**, *36*, 5–10. (In Japanese)
28. Harada, K. Therapy of bovine sarcoptidosis with ivermectin. *Kachiku Shinryo* **1994**, *374*, 27–29. (In Japanese)
29. Nagata, T.; Roncalli, R.A.; Mishiba, T.; Matsuoka, K.; Yamada, K.; Ura, S. Efficacy of ivermectin pour-on formulation against naturally infected mange mites (*Chorioptes* spp.) in cattle. *Jpn. Bull. Anim. Hyg.* **1995**, *41*, 27–33.
30. Fukumoto, S.; Morishima, Y.; Arakaki, H.; Mochizuki, K.; Kurosawa, N.; Homma, T.; Takahashi, T. Coinfection of *Chorioptes texanus* and *C. bovis* in Holstein heifers in the eastern Hokkaido, Japan. *Jpn. J. Anim. Hyg.* **2007**, *33*, 41–45.
31. Fukumoto, S.; Ohtani, S.; Ikeda, W.; Sano, T.; Takahashi, T.; Ikeda, K.; Fuji, E.; Kojima, H.; Tokuyama, K.; Kakizaki, R. A survey of bovine chorioptic mange in Japan: Concomitant infection with *Chorioptes bovis* and *C. In texanus*. In Proceedings of the 30th World Buiatrics Congress, Sapporo, Japan, 28 August–1 September 2018; Abstract. p. 277.
32. Ohtani, S.; Ikeda, K.; Ikeda, K.; Fukumoto, S.; Murata, R.; Fujii, E.; Kakizaki, R.; Tokuyama, K. Status of infection with *Chorioptes* mites, the cause of mange in cattle in Japan. *Jpn. Soc. Vet. Sci. Ann. Proc.* **2018**, *161*, 322. (In Japanese)
33. Suh, G.-H.; Hur, T.-Y.; Lim, S.; Shin, S.-M.; Kwon, J.; Cho, S.-H.; Lee, C.-Y.; Shin, S.-S. The first outbreak of *Chorioptes texanus* (Acari: Psoroptidae) infestation in a cattle farm in Korea. *Korean J. Parasitol.* **2008**, *46*, 273–278. [[CrossRef](#)] [[PubMed](#)]
34. Hur, T.-Y.; Kang, S.-J.; Jung, Y.-H.; Choi, C.-Y.; Ryu, I.-S.; Son, D.-S.; Kang, T.-Y.; Shin, S.-S.; Kim, H.-J.; Suh, G.-H. Therapeutic effect of eprinomectin against *Chorioptes texanus* in naturally infected dairy cows reared in Korea. *J. Vet. Clin.* **2009**, *26*, 450–456. (In Korean)

35. Faccini, J.L.H.; Leite, A.C. Combined chorioptic mange and dermatophilosis in a dairy cattle herd. Case report. *Rev. Bras. Parasitol. Vet.* **1996**, *5*, 127–128.
36. Schlater, J.L.; Mertins, J.W. Mange. In *OIE Manual on Diagnostic Tests and Vaccines for Terrestrial Animals*; OIE: Paris, France, 2008; pp. 1255–1266.
37. Foster, A.; Mitchell, S.; Wall, R. Cattle ectoparasites in Great Britain. *Cattle Pract.* **2015**, *23*, 280–287.
38. Oku, Y.; Mistushiba, T.; Takeuchi, K.; Tanemura, K. *Chorioptes texanus* on cattle in Japan. *Jpn. J. Sanit. Zool.* **1994**, *45*, 197. (In Japanese)
39. Oku, Y.; Playford, C.; Kamiya, M.; Takeuchi, K. *Chorioptes texanus* in Japanese cattle. *Jpn. Soc. Vet. Sci. Ann. Proc.* **1991**, *112*, 100. (In Japanese)
40. Barth, D.; Preston, J.M. Efficacy of topically administered ivermectin against chorioptic and sarcoptic mange of cattle. *Vet. Rec.* **1988**, *123*, 101–104. [[CrossRef](#)]
41. Barth, D.; Hair, J.A.; Kunkle, B.N.; Langholff, W.K.; Löwenstein, M.; Rehbein, S.; Smith, L.L.; Eagleson, J.S.; Kutzer, E. Efficacy of eprinomectin against mange mites in cattle. *Amer. J. Vet. Res.* **1997**, *58*, 1257–1259. [[CrossRef](#)] [[PubMed](#)]
42. Fujii, E.; Ikeda, K.; Fukumoto, S. Therapeutic efficacy of eprinomectin in dairy cattle solely infested with *Chorioptes bovis*. *Jpn. Soc. Vet. Sci. Ann. Proc.* **2018**, *161*, 322. (In Japanese)
43. Hirst, S. On a new mite of the genus *Chorioptes* parasitic on goats in the United States. *Ann. Mag. Nat. Hist. Ser. 9* **1924**, *13*, 538. [[CrossRef](#)]
44. Hirst, S. Descriptions of new mites, including four new species of “Red Spider”. *Proc. Zool. Soc. Lond.* **1926**, *96*, 825–841. [[CrossRef](#)]
45. Oudemans, A.C. *Chorioptes caprae* (Del. & Bourg. 1858). *Tijdschr. Entomol.* **1926**, *69*, 1–18.
46. Von Maydell, A. Zur Morphologie von Sarcoptes, Psoroptes und Chorioptes (Acarina). Ph.D. Thesis, Vet. School, Hannover, Germany, 1961.
47. Dorny, P.; van Wyngaerden, T.; Vercruysse, J.; Symoens, C.; Jalila, A. Survey on the importance of mange in the aetiology of skin lesions in goats in peninsular Malaysia. *Trop. Anim. Health Prod.* **1994**, *26*, 81–86. [[CrossRef](#)]
48. Chaithanya, C.; Biju, P.H.; Sindhu, O.K.; Janus, A.; Ravindran, R.; Ajith Kumar, K.G.; Ajithkumar, S. *Chorioptes texanus* causing mange in goats: Comparison of two therapeutic protocols. *J. Vet. Anim. Sci.* **2021**, *52*, 357–361.
49. Faccini, J.L.H.; Leite, R.C.; Leite, R.C. Sobre três casos de parasitismo por ácaros. *Arq. Univ. Fed. Rural. Rio Jan.* **1991**, *14*, 97–100.
50. Chen, C.-C.; Pei, K.J.-C. Case report: The first report on mange infestation in wild Formosan serows (*Capricornis swinhoei*) in Taiwan. *Taiwan Vet. J.* **2007**, *33*, 181–185. (In Chinese)
51. Hestvik, G.; Zahler-Rinder, M.; Gavier-Widén, D.; Lindberg, R.; Mattsson, R.; Morrison, D.; Bornstein, S. A previously unidentified *Chorioptes* species infesting outer ear canals of moose (*Alces alces*): Characterization of the mite and the pathology of infestation. *Acta Vet. Scand.* **2007**, *49*, 21–30. [[CrossRef](#)] [[PubMed](#)]
52. Kadulski, S. Pasożyty zewnętrzne łosia (*Alces alces*) w Polsce. In Proceedings of the Mat XVI Zjazdu Polsk Towarzystwa Parazytol, Poznań, Poland, 12–13 September 1991; p. 12.
53. Kadulski, S. Ectoparasites of Cervidae in north-east Poland. *Acta Parasitol.* **1996**, *41*, 204–210.
54. Kadulski, S. Dalsze badania i stawonogami pasożytniczymi łosia *Alces alces* w Polsce. *Wiad. Parazytol.* **1996**, *42*, 349–355.
55. Kadulski, S. Ectoparasites of sika deer in Poland. *Acta Parasitol.* **2000**, *45*, 163.
56. Szczurek, B.; Kadulski, S. Ectoparasites of fallow deer, *Dama dama* (L.) in Poland. *Acta Parasitol.* **2004**, *49*, 80–85.

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