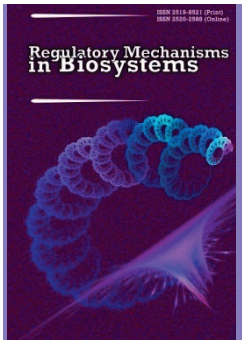

Regulatory Mechanisms in Biosystems

ISSN 2519-8521 (Print)
ISSN 2520-2588 (Online)
Regul. Mech. Biosyst.,
2024, 15(1), 76–82
doi: 10.15421/022411

Morphological features of the causative agent of chorioptic mange isolated from cattle

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Article info

Received 02.12.2023
Received in revised form 09.01.2024
Accepted 27.01.2024

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Melnychuk, V., Kovalenko, S., Yevstafieva, V., Korchan, L., Kone, M., Titarenko, O., & Nikiforova, O. (2024). Morphological features of the causative agent of chorioptic mange isolated from cattle. Regulatory Mechanisms in Biosystems, 15(1), 76–82. doi:10.15421/022411

Providing veterinary care against parasitic diseases is one of the factors that affect the possibility of effective and profitable introduction of the livestock sector. Chorioptic mange is one of the globally spread invasive diseases of cattle caused by persistent ectoparasites. The diagnosis of chorioptosis is based on the microscopic detection of mites in scrapings from the skin of the affected animal with mandatory identification of the parasites. The aim of the research was to investigate the morphological features and metric parameters of *Chorioptes* mites isolated from cattle. Mites isolated from cattle were morphometrically identified as *Chorioptes texanus*. Morphological features of male *Ch. texanus* mites include peculiarities in the structure of the opisthosomal lobes and of the setae located on the opisthosomal lobes, opisthosoma and tarsus of leg III. 14 morphometric parameters characterizing the general structure of the body (length, width and their ratio, length and width of the gnathosoma, length of the idiosoma, proterosoma, podosoma, propodosoma, metapodosoma, hysterosoma, opisthosoma, length and width of the propodosomal shield) were identified and suggested for use in identification of male and female *Ch. texanus*. In male mites of this species, 5 additional parameters were also determined, which describe the length and width of the opisthomal lobes, their ratio, the diameter of the adanal suckers and the distance between them. The morphological features, location and length of 6 setae, which are species-specific in *Chorioptes* mites, namely 4 setae of the opisthosomal lobe, 1 opisthosomal seta, 1 ventral seta of tarsus III, were described. The parameters of *Ch. texanus* eggs in the bodies of female mites and on the body of the host animal were determined. The scientific data obtained in this study expand the already existing data on the differential identification of *Ch. texanus* mites and proves their parasitism in cattle on the territory of Ukraine.

Keywords: acariform mites; *Chorioptes texanus*; infestation; differential diagnostics; metric parameters.

Introduction

Acariform mites (Acariformes) include species that are permanent parasites of mammals, and are extremely diverse both taxonomically and ecologically. These mites inhabit the skin surface of their hosts, hair follicles and skin glands, and also live directly in the skin or subcutaneous connective tissue (Evans, 1992; Yeruham et al., 1999a; Bochkov, 2010; Dabert et al., 2010).

Among of the common cutaneous ectoparasites parasitizing ruminants are mites of the genus *Chorioptes*. Chorioptosis (chorioptic mange) is often diagnosed in cattle regardless of their breed, age and method of keeping in almost all climatic zones. Disease caused by chorioptic mites can become widespread among susceptible livestock and cause significant economic losses to the industry (Rehbein et al., 2005; Kollbrunner et al., 2009, 2010; Vieira et al., 2014; Asmare et al., 2016). The acariasis can be acute, subacute or chronic, characterized by inflammation of the skin, itching in the infested body areas, hair loss, skin thickening, the presence of scabs, crusts and cracks on it, mainly in the area of the limbs, the root of the tail, as well as exhaustion of host animals. All this together leads to a decrease in their productivity, a decrease in the quality of skin and the breeding value of animals (Rhodes, 1976; Shibata et al., 2003; Nematollahi et al., 2007; Reddy et al., 2013). Therefore, for the purpose of timely diagnosis of this disease and for monitoring purposes to assess and track changes in the epizootic situation regarding chorioptosis, accurate identification of pathogens is relevant.

In particular, scrapings taken from the affected areas of the skin are examined in order to detect mites of the genus *Chorioptes* on the host's body. These methods of laboratory diagnosis of acariasis are based on the detection of eggs, larvae, nymphs and sexually mature mites in the obtained material (Donald, 1970; Bunyaratavej et al., 2016; Alvares et al., 2021). However, without conducting genetic studies, it is possible to identify the species of mites, isolated from sample scrapings only by examining the shape, size and morphological structure of the mites themselves, in particular the opisthosomal lobes and setae in the sampled mature mites (Klimov & Oconnor, 2008; Suh et al., 2008; Amer et al., 2015).

Today, six species of chorioptic mites are known: *Ch. bovis* (von Hering, 1845) and *Ch. texanus* Hirst, 1924 from various species of even-toed ungulates and horses, *Ch. crewei* Lavoipierre, 1958 from duiker in Cameroon, *Ch. panda* Fain and Leclerc, 1975 from several ursids, *Ch. mydaus* Fain, 1975 from the Sunda stink badger (Lavoipierre, 1958; Fain & Leclerc, 1975) and *Ch. sweatmani* Bochkov et al., 2014 from moose. *Ch. bovis* and *Ch. texanus* differ morphologically mainly in the structure of the opisthosoma and setae in males and their sizes (Sweatman, 1957; Bochkov et al., 2014). Before the review of Bochkov et al. (2014), *Ch. crewei* and *Ch. mydaus* were considered dubious (Zahler et al., 2001; Wang et al., 2012; Suh et al., 2008) and *Ch. sweatmani* was suspected based on data of molecular and morphometry studies, but not properly described (Hestvik et al., 2007; Lusat et al., 2011).

A significant number of researchers report the isolation of *Ch. texanus* from both domestic and wild animals, including goats in Texas, reindeer

in Canada, cattle in Brazil, Israel, Germany, and the United States, and moose in Poland. Also, this species of *Chorioptes* was isolated from cattle and goats in Southeast Asian countries, Japan and Malaysia, as well as from Holstein cattle in Korea (Dorny et al., 1994; Nagata et al., 1995; Zahler et al., 2001; Suh et al., 2008).

Therefore, mites of the genus *Chorioptes* are an important veterinary problem, where the basis of a clear diagnosis of infestation is knowledge of the taxonomic characteristics of the parasites. Conducting an extended analysis of the morphological structures of *Chorioptes* spp., establishing their metric parameters is a relevant direction of research.

The aim of the research was to investigate the morphological features and metric parameters of *Chorioptes* mites isolated from cattle.

Materials and methods

The study was carried out in the conditions of the Laboratory of Parasitology and Veterinary and Sanitary Examination of the Poltava State Agrarian University (Ukraine) in 2022–2023. The research protocol of the current study was approved by the Ethics Committee of the Poltava State Agrarian University (Approval number: 2023/8).

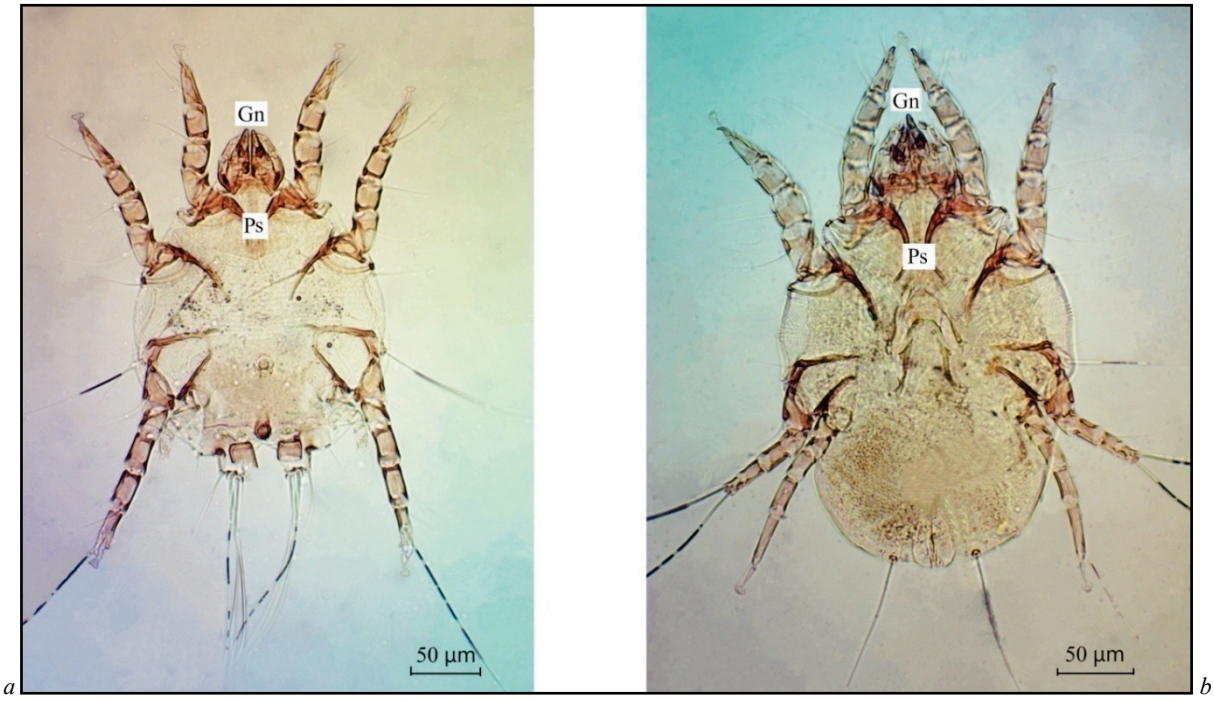
Mites were isolated from skin scrapings from infested cattle at Komyshuvatsky Dairy Complex LLC, Krasnohrad district of Kharkiv region (Ukraine). *Chorioptes* mites were mounted on slides according to the proposed method (Melnychuk & Kovalenko, 2023). Species identification was carried out according to the available identification keys (Sweatman, 1957; Bochkov et al., 2014).

The morphometric parameters of male (n = 20) and female (n = 20) *Chorioptes* mites were studied using ImageJ for Windows® software (version 2.00) in interactive mode. Microphotography was carried out using a Sigeta M3CMOS 14000 14.0 MP digital camera (China).

Statistical processing of the experimental results was carried out using Statistica 10 (StatSoft Inc., USA) software. Standard deviation (SD) and average values (x) were calculated.

Results

Based on morphological and metrical studies of mites isolated from cattle, they were identified as *Chorioptes texanus*. The mites have an oval-shaped body, flattened in the dorsoventral direction, covered with a striated cuticle. The body is divided into the gnathosoma and the idiosoma. The gnathosoma is wide, short, of a gnawing type, subquadrate. The chelicerae do not protrude beyond the tip of the palps. The idiosoma is divided by a transverse groove into a propodosoma (anterior part) and a hysterosoma (posterior part). Each of these parts bears two pairs of legs (legs I, II and III, IV). The hysterosoma contains the metapodosoma, which includes segments of the two hind pairs of legs (legs III and IV) and the opisthosoma posterior to them. The separation of opisthosoma and metapodosoma is not visible on the micro-preparation. On the dorsal surface of mites there are propodonotal and hysteronotal cuticular shields, which contain a number of mostly short hair-like setae. The propodosomal shield is very narrow, widens slightly trapezoidally at the posterior end, occupies almost the entire middle part of the propodosoma. The legs consist of five moving segments: the trochanter, femur, genu, tibia, and tarsus. The tarsus, in turn, is divided into pretarsus and ambulacrum. The coxae are completely fused with the idiosoma. The pretarsi are long and developed. Males (Fig. 1a) are visually smaller than females (Fig. 1b).



a *b*

Fig. 1. General morphological structure of *Chorioptes texanus* mites isolated from cattle:
a – males, *b* – females; gnathosoma (*Gn*), propodosomal shield (*Ps*)

In male *Ch. texanus*, opisthosomal lobes are almost square, massive, consist of a larger and smaller (additional) part. Opistosomal lobes are separated by a triangular slit. Anal copulatory suckers are very large, placed in the middle of the ventral side of the opisthosoma (Fig. 2). Also, legs IV in males are much shorter than the legs III. All pairs of legs end with ambulacral suckers on unarticulated stalks. Legs III showing long seta on the tarsus (Fig. 3).

When studying the morphometric features of the male isolated *Ch. texanus* mites, 19 indicators were defined that describe the general structure of the body (Table 1). In other studies, from 2 to 6 body parameters of conspecific mites have been determined, namely: total length and width of the body, length of the gnathosoma, length of the idiosoma, length and width of the propodosomal shield. We additionally determined the ratio of body length to width (1.0–1.3 : 1), the width of the gnathosoma at its base (31.2–42.5 µm), the length indicators of the proterosoma (114.9–166.6 µm), podosoma (126.2–169.9 µm), propodosoma (64.1–115.8 µm), metapodosoma (50.5–68.3 µm), hysterosoma (86.0–101.7 µm), opisthosoma (27.7–41.0 µm), length and width of opisthosomal lobes (22.4–37.9 and 21.4–37.5 µm), their ratio (1.0–1.2 : 1), diameter of adanal suckers (18.2–27.1 µm), distance between adanal suckers (16.8–21.1 µm).

The morphological and metric characteristics of 6 setae located on the opisthosoma, opisthosomal lobes, and ventral surface of the tarsus III of the studied mites were also determined, which are important characters for identification of *Chorioptes* (Table 2, Fig. 4).

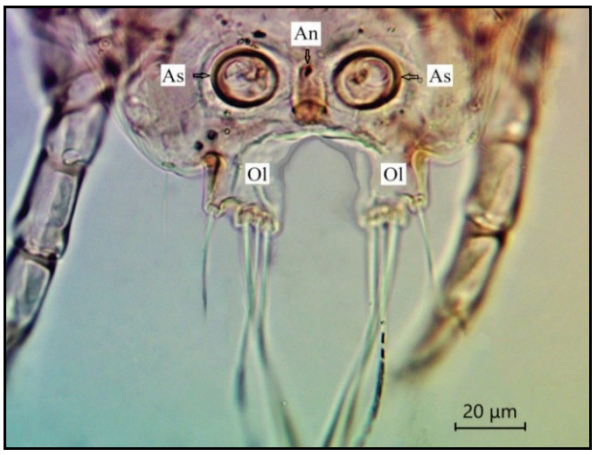


Fig. 2. Opisthosoma of *Chorioptes texanus* mites: adanal sucker (*As*), opistosomal lobe (*Ol*), anus (*An*)

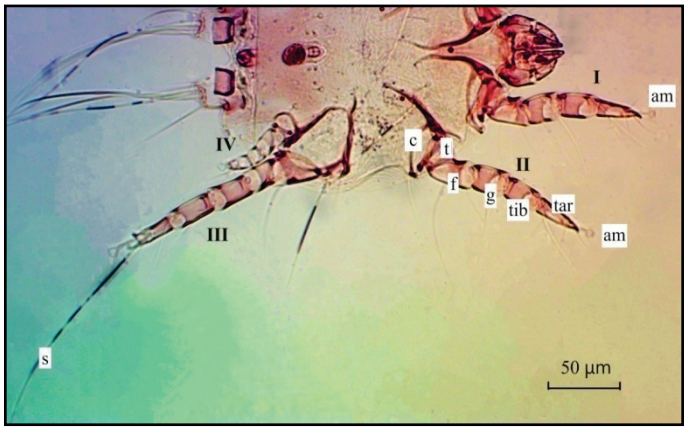


Fig. 3. Leg morphology of male *Chorioptes texanus* mites (ventral view): legs I (*I*), legs II (*II*), legs III (*III*), legs IV (*IV*); coxa (*c*), trochanter (*t*), femur (*f*), genu (*g*), tibia (*tib*), tarsus (*tar*), seta (*s*), ambulacrum (*am*)

Table 1

Metric parameters of adult male mites of *Chorioptes texanus*, isolated from cattle, n = 20 (x ± SD, min–max)

Parameters, µm	Present specimens	Suh et al. (2008)	Rosen et al. (1989)
Length of body	236.1 ± 10.3 (216.1–254.6)	239.0 ± 14.6 (220–265)	279.7 ± 31.2 (210–336)
Width of body	198.4 ± 7.1 (183.1–209.5)	198.8 ± 8.4 (185–220)	221.1 ± 21.1 (175–280)
Length to width of body ratio	1.2 : 1 (1.0–1.3 : 1)	–	–
Length of gnathosoma	52.3 ± 4.2 (42.9–60.1)	53.5 ± 3.1 (50–63)	–
Width of gnathosoma at the base	35.1 ± 3.7 (31.2–42.5)	–	–
Length of idiosoma	183.8 ± 11.4 (165.3–203.4)	191.1 ± 13.3 (175–213)	–
Length of proterosoma	141.3 ± 13.1 (114.9–166.6)	–	–
Length of podosoma	146.9 ± 11.8 (126.2–169.9)	–	–
Length of propodosoma	89.0 ± 14.5 (64.1–115.8)	–	–
Length of metapodosoma	57.9 ± 4.0 (50.5–68.3)	–	–
Length of hysterosoma	94.8 ± 4.4 (86.0–101.7)	–	–
Length of opisthosoma	37.0 ± 3.1 (27.7–41.0)	–	–
Length of propodosomal shield	54.3 ± 7.4 (42.4–68.3)	58.3 ± 8.5 (40–70)	–
Width of propodosomal shield	60.3 ± 6.1 (50.3–70.1)	61.5 ± 7.0 (48–73)	–
Length of opisthosomal lobes	29.5 ± 4.0 (22.4–37.9)	–	–
Width of opisthosomal lobes	27.6 ± 4.1 (21.4–37.5)	–	–
Length to width of opisthosomal lobes ratio	1.1 : 1 (1.0–1.2 : 1)	–	–
Diameter of adanal suckers	22.4 ± 2.4 (18.2–27.1)	–	–
Distance between adanal suckers	18.7 ± 1.3 (16.8–21.1)	–	–

Note: "–" – parameters were not defined.

Table 2

Length of setae of adult male mites of *Chorioptes texanus*, isolated from cattle, n = 20 (x ± SD, min – max)

Parameters, µm	Present specimens	Suh et al. (2008)	Sweatman (1958)	Hestvik et al. (2007)	Rosen et al. (1989)	Puzanova (2011)
1 (seta of outer angle of opisthosomal lobe)	59.1 ± 8.6 (38.2–72.6)	61.1 ± 8 (35–75)	80 ± 7.5 (66–98)	54.2 ± 7.3 (37–69)	62.7 ± 8 (42–70)	(37–69)
2 (lanceolate seta on opisthosomal lobe)	163.1 ± 16.6 (132.8–182.1)	172.3 ± 8.9 (160–200)	216 ± 10.2 (193–235)	164 ± 8 (145–185)	169.1 ± 17.1 (140–210)	(145–185)
3 (central seta on opisthosomal blade)	210.2 ± 14.6 (183.2–233.6)	–	–	–	–	–
4 (seta at the caudal body margin)	22.6 ± 6.6 (12.7–33.8)	26.6 ± 4.8 (17.5–35.0)	25 ± 1.4 (23–27)	24.9 ± 3.9 (16–32)	17.2 ± 1.94 (10.5–21.0)	(16–32)
5 (seta of inner angle of opisthosomal lobe)	24.7 ± 4.3 (18.6–33.8)	26.4 ± 5.8 (15.0–37.5)	31 ± 2.9 (27–39)	24.3 ± 5.4 (13–32)	15 ± 8 (7–35)	(13–32)
6 (ventral seta at tarsus III)	16.8 ± 4.7 (9.4–24.6)	20.3 ± 7.5 (7.5–40.0)	18 ± 3.3 (14–29)	18.3 ± 7.2 (8–40)	–	(8–40)

Note: "–" – parameters were not defined.

Thus, the seta of the outer angle of the opisthosomal lobe was thin, located laterally-apically on a small additional lobe, forming a small angle in relation to the apical part of the opisthosomal lobe. This seta was separated from a group of three other setae. It was short, measuring 59.1 ± 8.6 µm. Two setae were located close to each other, emerging from the apical edge of the opisthosomal lobe. Those setae were flattened, almost lanceolate, straight and tapered at ends. They were quite long, measuring 163.1 ± 16.6 µm. The central seta was the longest, of constant width, 210.2 ± 14.6 µm in length. The seta of the inner angle of the opisthosomal lobe was thin, short, 24.7 ± 4.3 µm in length. The seta at the caudal body margin was located posterolaterally on the opisthosoma, short, 22.6 ± 6.6 µm in length. One ventral seta of tarsus III was the shortest compared to the other examined setae and was 16.8 ± 4.7 µm.

Females morphologically had a more rounded body compared to males. The oviduct opening is very large, it is a transverse slit, located at the base of the epimere II. Legs III and IV are more slender compared to those of males. Also, in females, legs III do not end with ambulacra, instead they end with long setae (Fig. 5). *Chorioptes* eggs are large, elongated-oval (Fig. 6a, 6b). When studying the morphometric features of the female *Ch. texanus* mites, 14 indicators are defined that describe the general structure of the body (Table 3).

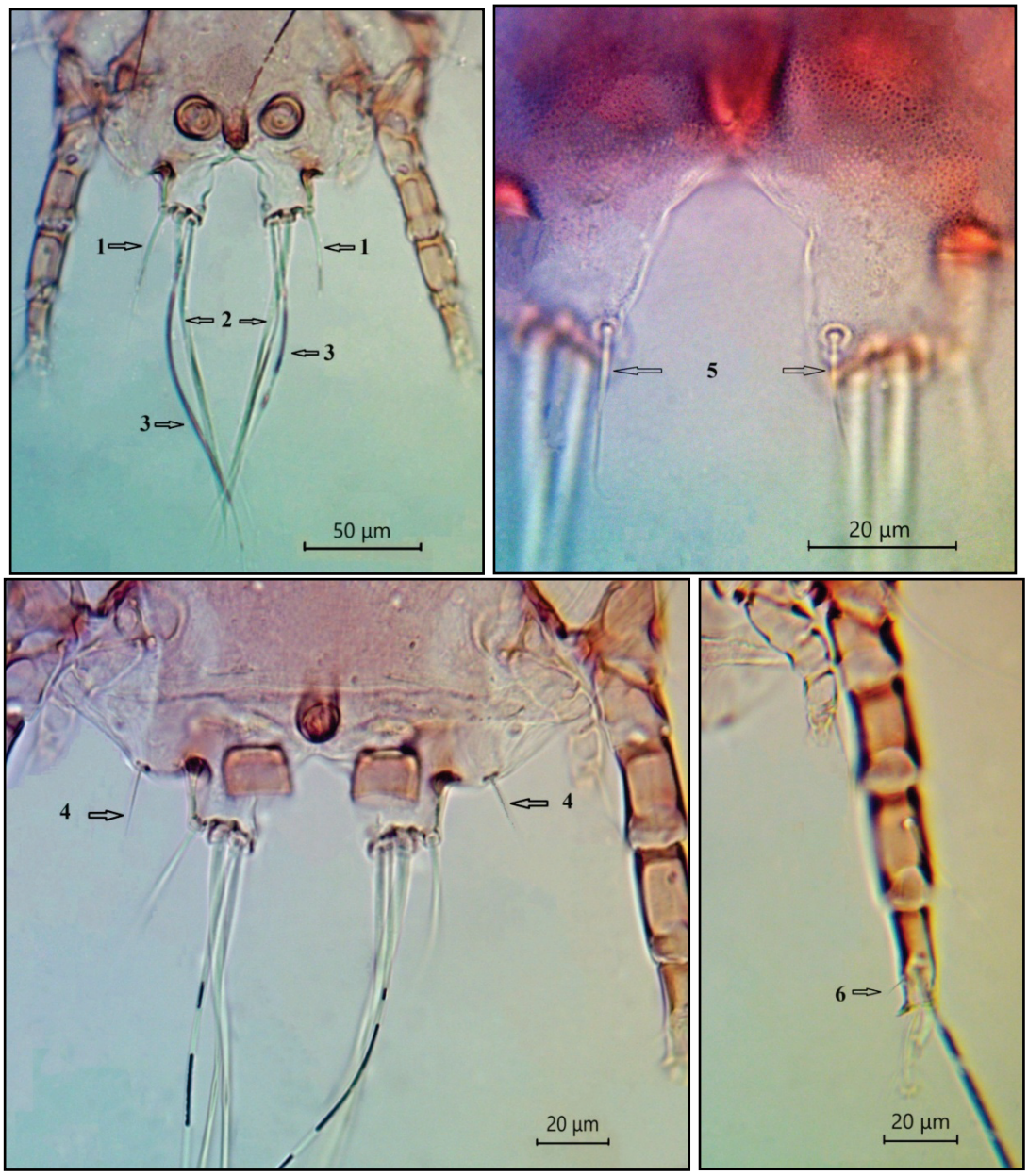


Fig. 4. Location and morphology of setae in adult male *Chorioptes texanus* mites: seta at the outer angle of the opisthosomal lobe (*1*), lanceolate setae on the opisthosomal lobe (*2*), central seta on the opisthosomal lobe (*3*), seta at the caudal body margin (*4*), seta of the inner angle of the opisthosomal lobe (*5*), ventral seta of tarsus III (*6*)

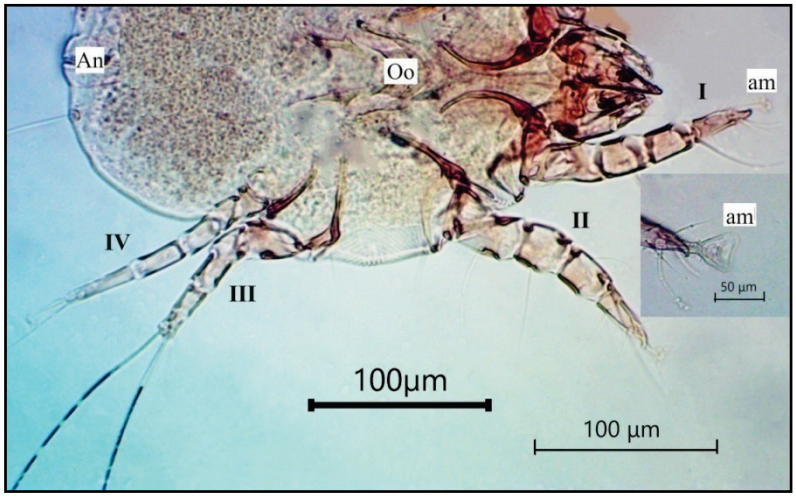


Fig. 5. Female mites of *Chorioptes texanus* (ventrally): oviduct opening (*Oo*), anal opening (*An*); legs I (*I*), legs II (*II*), legs III (*III*), legs IV (*IV*), long seta (*s*), ambulacrum (*am*)

Fig. 6. Morphology of eggs of *Chorioptes texanus* mites: dorsally in the female body (*a*), isolated from skin scrapings of cattle (*b*)

Table 3

Metric parameters of adult female mites of *Chorioptes texanus*, isolated from cattle, n = 20 (x ± SD, min – max)

Parameters, µm	Present specimens	Suh et al., 2008	Rosen et al., 1989
Length of body	347.3 ± 31.5 (283.1–402.6)	373.5 ± 32.7 (325–440)	350.4 ± 46.1 (280–420)
Width of body	243.2 ± 22.4 (206.3–270.4)	239.6 ± 42.4 (113–300)	237.0 ± 28.2 (196–280)
Length to width of body ratio	1.4 : 1 (1.1–1.8 : 1)	–	–
Length of gnathosoma	70.2 ± 6.9 (49.0–79.6)	71.4 ± 7.1 (63–80)	–
Width of gnathosoma at the base	55.6 ± 4.6 (41.0–60.4)	–	–
Length of idiosoma	277.1 ± 27.8 (228.6–323.0)	315.5 ± 34.2 (255–380)	–
Length of proterosoma	174.9 ± 18.1 (128.8–196.9)	–	–
Length of podosoma	171.0 ± 20.8 (136.6–206.2)	–	–
Length of propodosoma	104.7 ± 13.8 (78.6–121.1)	–	–
Length of metapodosoma	66.3 ± 10.3 (51.0–88.0)	–	–
Length of hysterosoma	172.4 ± 16.8 (142.0–205.7)	–	–
Length of opisthosoma	106.1 ± 9.2 (91.0–123.5)	–	–
Length of propodosomal shield	69.7 ± 3.0 (64.3–76.4)	82.1 ± 5.9 (70–90)	–
Width of propodosomal shield	78.9 ± 4.0 (71.2–83.9)	80.3 ± 5.8 (68–90)	–
Length of egg in female mite's body	138.1 ± 6.5 (126.6–146.5)	–	–
Width of egg in female mite's body	76.8 ± 6.2 (60.8–82.9)	–	–
Length of egg from the skin scraping off host animal	156.9 ± 6.6 (148.6–170.5)	166.0 ± 12.9 (150–190)	–
Width of egg from the skin scraping off host animal	70.1 ± 2.9 (65.7–74.8)	88.5 ± 14.0 (65–110)	–

Note: "–" – parameters were not defined.

Other studies provide from 2 to 6 parameters of the body of mites of this species, namely: the total length and width of the body, the length of the gnathosoma, the length of the idiosoma, the length and width of the propodosomal shield. We additionally determined the ratio of body length to width (1.1–1.8 : 1), the width of the gnathosoma in the area of the base (41.0–60.4 µm), the length indicators of the proterosoma (128.8–196.9 µm), podosoma (136.6–206.2 µm), propodosoma (78.6–121.1 µm), metapodosoma (51.0–88.0 µm), hysterosoma (142.0–205.7 µm), and opisthosoma (91.0–123.5 µm).

The sizes of the eggs found in different substrates were determined. In particular, eggs of *Ch. texanus* found in the body of females had a length of 138.1 ± 6.5 µm (126.6–146.5 µm) and a width of 76.8 ± 6.2 µm (60.8–82.9 µm). Mite eggs isolated from the host's skin were longer, 156.9 ± 6.6 µm (148.6–170.5 µm) and narrower, 70.1 ± 2.9 µm (65.7–74.8 µm) than the eggs found in the female's body.

Discussion

Chorioptosis of cattle is recorded in many countries of the world, especially during the stall period in the autumn-winter season. The infestation can lead to significant economic losses in the livestock industry (Kollbrunner et al., 2010; Vieira et al., 2014; Asmare et al., 2016). Therefore, timely detection and identification of its causative agent requires knowledge of their morphometric features. The relevance of such studies is due to the fact that the species identification of *Chorioptes* is complicated due to the high variability of "standard" diagnostic signs, which has led some researchers to conclude the validity of only *Chorioptes bovis* and *Ch. texanus*, which are morphologically distinguished by differences in the shape and length of the opisthosomal setae of adult males, and the difference between these two species has been confirmed by genetic studies (Sweatman, 1957, 1958; Essig et al., 1999; Zahler et al., 2001). Later, the validity of four species of *Chorioptes*, namely: *Ch. bovis*, *Ch. panda*, *Ch. texanus*, *Ch. sweatmani* was confirmed in genetic and morphological studies, and although genetic studies for *Ch. crewei* and *Ch. mydaus* was not performed, the mite morphology strongly suggests their validity (Bochkov et al., 2014).

Based on our morphometric studies of mites isolated from cattle in Ukraine, the parasite was identified as *Ch. texanus*. This is the first report of finding this species in Ukraine. The general morphological structure of the body in both males and females of the collected mites was typical for the genus *Chorioptes*. At the same time, in males, the opisthosomal lobes were subquadrate, massive, included larger and smaller (additional) parts and were separated from each other by a triangular gap. These morphological features of *Ch. texanus* are described in other works (Suh et al., 2008; Puzanova, 2011).

For the male mites of *Ch. texanus*, we determined 19 morphometric parameters that describe the general structure of the body, namely: total length, body width and their ratio, length and width of the gnathosoma and propodosomal shield, length of the idiosoma, proterosoma, podosoma, propodosoma, metapodosoma, hysterosoma, opisthosoma, length and width of the opisthosoma lobes, their ratio, diameter of adanal suckers, distance between adanal suckers. Other authors describe from 2 to 6 parameters characterizing the total length and width of the body, the length of the gnathosoma, the length of the idiosoma, the length and width of the

propodosomal shield (Rosen et al., 1989; Suh et al., 2008). Our data are consistent with the results of research by some authors (Suh et al., 2008). At the same time, other scientists have recorded larger values of body length and width of mites of the species *Ch. texanus* – 279.7 ± 31.2 μm (210–336 μm) and 221.1 ± 21.1 μm (175–280 μm), respectively (Rosen et al., 1989). However, according to the identification keys for mites of the genus *Chorioptes*, the length of the body with the gnathosoma can vary from 220 to 295 μm (Bochkov et al., 2014).

Also, we determined the morphological and metric characteristics of 6 setae located on the opisthosoma, opisthosoma lobes, and the ventral surface of tarsus III of the collected mites, which are among the main differential characters of *Chorioptes*. There were 5 setae on each opisthosomal lobe. Among them, the central seta was the longest (210.2 ± 14.6 μm). Next to it were 2 lanceolate setae that did not contain bends. They were shorter (163.1 ± 16.6 μm) than the central seta. The setae of the outer angle of the opisthosomal lobe were shorter than 100 μm (59.1 ± 8.6 μm). The seta of the inner angle of the opisthosomal lobe was even shorter than the former (24.7 ± 4.3 μm). The shortest setae were on the caudal part of the opisthosoma (22.6 ± 6.6 μm) and tarsus III (16.8 ± 4.7 μm). The data obtained by us are consistent with the keys and morphological studies of most authors, which confirms the classification of the detected mites to the species *Ch. texanus* (Sweatman, 1958; Zool, 1958; Rosen et al., 1989; Hestvik et al., 2007).

Female mites found were larger and rounder compared to males, which was confirmed by their metric parameters. We determined 14 indicators in adult female mites that, like in males, describe the general structure of the body, namely: total length, body width and their ratio, length and width of the gnathosoma and propodosomal shield, length of the idiosoma, proterosoma, podosoma, propodosoma, metapodosoma, hysterosoma, opisthosoma. Other authors describe from 2 to 6 parameters characterizing the total length and width of the body, the length of the gnathosoma, the length of the idiosoma, the length and width of the propodosomal shield (Rosen et al., 1989; Suh et al., 2008). The data obtained by us have minor discrepancies with the data of the above-mentioned authors, which is associated with the parasitism of mites of this species on different hosts (Hirst, 1924; Kadulski, 1996; Yeruham et al., 1999b; Bochkov et al., 2014). The scientific data obtained in this study extend the already existing data on the differential identification of *Ch. texanus* mites and prove their parasitism in cattle on the territory of Ukraine.

Conclusion

According to the results of morphological and metric studies, mites isolated from cattle in Ukraine were identified as *Chorioptes texanus*. The morphological structure of males and females of collected mites is described. 19 morphometric indicators were determined in males and 14 in females, which characterize their overall size, length and width of different parts of the body, gnathosoma, propodosomal shield, as well as in males – the size of the opisthosomal lobes, the diameter of the adanal suckers and the distance between them. In addition, the morphological characteristics, location and length of six setae (of the opisthosomal blade, outer and inner angle, lanceolate, central; seta on the caudal part of the opisthosoma; ventral seta of tarsus III) are described, which are the main keys in differentiating *Chorioptes* mites. The sizes of mite eggs found in different substrates (body of female mite and host skin) were determined. The results of our research complement existing scientific data and will be useful in differentiating mites of the genus *Chorioptes*.

The research was carried out within the framework of the initiative topic of scientific work "Monitoring, implementation of improved methods of diagnosis, treatment and prevention of invasive animal diseases" (state registration No. 0121U100644).

The authors state that there is no conflict of interest.

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