

Original papers

***Demodex acutipes* Bukva et Preisler, 1988 (Acari, Demodecidae) – a rare parasite of red deer (*Cervus elaphus* L.)**

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ABSTRACT. Two species of demodectic mites were described in the red deer *Cervus elaphus*, including *Demodex kutzeri*, which had also been found in other species of the Cervidae family in Austria, Germany, Czech Republic, Poland and North America. Whereas the other species, *D. acutipes*, had been previously known from only one finding in the Czech Republic. The present research included skin samples taken in winter 2012 from thirty red deer in northern Poland. *Demodex acutipes* (prevalence 20%, mean intensity 4.5), *D. kutzeri* (53.3%, 69.8) and fifteen *Demodex* sp. specimens (6.7%, 7.5), were found. *D. acutipes* is a new species for the fauna of Poland.

Key words: *Demodex acutipes*, *Demodex kutzeri*, demodectic mites, skin mites, red deer

Introduction

Skin mites from the family of Demodecidae are frequent skin parasites of ungulates [1]. So far, sixteen usually specific species were described (Table 1), including eight species recorded in Poland [1,2]. Two species – *Demodex kutzeri* Bukva, 1987 (= *Demodex cervi* sensu Kutzer et Grünberg, 1972) and *Demodex acutipes* Bukva et Preisler, 1988 – are known from the European cervids. Furthermore, an unidentified *Demodex* sp. was found in the red deer, described by Bukva and Preisler [3]. In Poland, only *D. kutzeri* was recorded to date. The species was found in 13–15% of the red deer from the northern part of the country [4,5]. It was also reported from Sika deer [6], roe deer and Eurasian elk [7], and is considered to be one of the few representatives of Demodecidae occurring in a few hosts [8].

D. acutipes, specific to the red deer, was previously found only in the Czech Republic. Despite extensive researches conducted on cervids, it was not reported from Poland. Therefore, it was recognised as a rare species, likely to be found in the future [2,9].

Materials and Methods

The study material consisted of skin samples of the thirty red deer *Cervus elaphus* collected in the Enterprise „Las”. The red deer came from shooting carried out by hunters in February 2012 in northern Poland. Skin samples were collected from the head (eyelids and eye region, chin, nose, lips), limbs (front and back), belly, dorsum, as well as genital and anal regions, and then they were fixed in 70% ethanol solution. They were examined applying the method of digestion and decantation [10]. Specimens of mites found were dissected in Faure’s solution and examined under a phase-contrast microscope.

Results

The occurrence of *Demodex acutipes*, *Demodex kutzeri* and *Demodex* sp. was determined in nineteen studied red deer. Twenty-seven specimens of *D. acutipes* were found in six red deer, including twenty females and seven males (Table 2, Fig. 1). All specimens came from skin of the head region (Table 3). *D. kutzeri* was found in sixteen red deer

Table 1. Demodectic mites of ungulates mammals

Species of demodecids	Host	Occurrence of world	Records from Poland
<i>Demodex acutipes</i> Bukva et Preisler, 1988	Red deer <i>Cervus elaphus</i> Linnaeus, 1758 (Cervidae)	Czech Republic [3], Poland	present
<i>Demodex aries</i> Desch, 1986	Sheep <i>Ovis aries</i> Linnaeus, 1758 (Bovidae)	New Zealand [14], Czech Republic [15]	likely to find [2,9]
<i>Demodex bantengi</i> Firda, Nutting et Sweatman, 1987	Banteng <i>Bos javanicus</i> d'Alton, 1823 (Bovidae)	Bali [16]	–
<i>Demodex bisonianus</i> Kadulski et Izdebska, 1996	European bison <i>Bison bonasus</i> Linnaeus, 1758 (Bovidae)	Poland [17–19]	[17-22]
<i>Demodex bovis</i> Stiles, 1892	Cattle <i>Bos taurus</i> Linnaeus, 1758 (= <i>Bos primigenius taurus</i> Bojanus, 1827) (Bovidae), and accidental - <i>Bison bonasus</i> (Bovidae)	in different parts of the world, probably cosmopolitan	[19,20,23,24]
<i>Demodex caballi</i> (Railliet, 1895) (redesc. Desch et Nutting 1978)	Horse <i>Equus caballus</i> Linnaeus, 1758 (= <i>Equus ferus caballus</i> Linnaeus, 1758) (Equidae)	in different parts of the world, probably cosmopolitan	[24,25]
<i>Demodex cafferi</i> Nutting et Guilfooy, 1979	African buffalo <i>Syncerus caffer caffer</i> (Sparman, 1779) (Bovidae)	South Africa [26, 27], Botswana [28]	–
<i>Demodex caprae</i> Railliet, 1895	Domestic Goat <i>Capra hircus</i> Linnaeus, 1758 (= <i>Capra aegagrus hircus</i> [Linnaeus, 1758]) (Bovidae)	in different parts of the world, probably cosmopolitan	[29]
<i>Demodex cervi</i> Prietsch, 1886; (sensu Prietsch, 1886, Hirst, 1919)	Sambar <i>Rusa unicolor</i> (Kerr, 1792) (= <i>Cervus aristotelis</i> G. Cuvier, 1823, <i>Cervus unicolor</i> Bechstein, 1799) (Cervidae)	Germany [30]	–
<i>Demodex equi</i> Railliet, 1895 (sensu Bennison, 1943)	Horse <i>Equus caballus</i> Linnaeus, 1758 (= <i>Equus ferus caballus</i> Linnaeus, 1758) (Equidae)	in different parts of the world, probably cosmopolitan	[25,31]
<i>Demodex kutzeri</i> Bukva, 1987 (= <i>D. cervi</i> sensu Kutzer et Grünberg, 1972)	Elk <i>Alces alces</i> Linnaeus, 1758, Red deer <i>Cervus elaphus</i> Linnaeus, 1758, Roe deer <i>Capreolus capreolus</i> Linnaeus, 1758, Sika deer <i>Cervus nippon pseudaxis</i> Temminck, 1838, Mule deer <i>Odocoileus hemionus</i> Rafinesque, 1817, White-tailed deer <i>O. virginianus</i> Zimmermann, 1780 (Cervidae)	Austria, Germany [6,11], Czech Republic [6], Poland [4, 5,7], North America [8]	[4,5,7]
<i>Demodex odocoilei</i> Desch et Nutting, 1974	White-tailed deer <i>Odocoileus virginianus</i> Zimmermann, 1780, Mule deer <i>O. hemionus</i> Rafinesque, 1817 (Cervidae)	North America [32-36]	–
<i>Demodex ovis</i> Railliet, 1895	Sheep <i>Ovis aries</i> Linnaeus, 1758 (Bovidae)	in different parts of the world, probably cosmopolitan	[37]
<i>Demodex phylloides</i> Csokor, 1879	Wild boar <i>Sus scrofa scrofa</i> Linnaeus, 1758, Domestic pig <i>Sus scrofa domestica</i> Erxleben, 1777 (Suidae)	in different parts of the world, probably cosmopolitan	[24,38-41]
<i>Demodex pseudaxis</i> Shpringolts-Shmidt, 1937 (? syn. <i>D. kutzeri</i> Bukva, 1987)	Dybowski's sika deer <i>Cervus nippon hortulorum</i> (= <i>C. hortulorum</i>) Swinhoe, 1864 (Cervidae)	Russia (Asian region) [12]	–
<i>Demodex tauri</i> Bukva, 1986	Cattle <i>Bos taurus</i> Linnaeus, 1758 (= <i>Bos primigenius taurus</i> Bojanus, 1827) (Bovidae)	Czech Republic [42]	likely to find [2,9]

Table 2. Body size (means, ranges, standard deviations, in µm) of adult stages of *Demodex acutipes*, new record from Poland

	Present		Bukva and Preisler [3]	
	Male N=7	Female N=20	Male N=20	Female N=20
Length of gnathosoma	23.3 [20.1-25.0] SD=2.3	27.6 [25.0-30.5] SD=2.0	24.7 SD=1.5	27.7 SD=1.2
Width of gnathosoma (at base)	30.7 [25.0-35.5] SD=4.5	35.1 [30.5-40.2] SD=3.0	35.4 SD=1.7	40.0 SD=2.1
Length of podosoma	82.7 [76.1-87.5] SD=4.6	76.2 [60.2-87.0] SD=9.0	75.9 SD=2.2	87.1 SD=2.8
Width of podosoma	57.7 [50.2-65.0] SD=6.4	56.7 [50.0-65.9] SD=5.2	53.7 SD=3.8	61.2 SD=4.2
Length of opisthosoma	80.8 [67.5-92.1] SD=10.2	92.7 [65.9-115.0] SD=16.4	91.8 SD=9.8	105.3 SD=7.4
Width of opisthosoma	45.9 [44.8-51.9] SD=2.3	50.5 [45.9-54.5] SD=3.0	45.1 SD=2.9	53.4 SD=3.0
Length of aedeagus	21.9 [21.6-22.8] SD=0.4	–	23.1 SD=0.8	–
Length of vulva	–	10.3 [9.5-11.6] SD=0.7	–	[9-12]
Total length of body	187.2 [172.5-192.2] SD=6.8	196.6 [165.2-225.9] SD=21.2	192.0 SD=10.8	220.2 SD=9.5

and was represented by 1117 specimens, including 357 females, 168 males, 268 nymphs, 124 protonymphs, 122 larvae and 78 eggs (Table 3, Fig. 2). The specimens found came also from the head skin, and also from the dorsum and genital regions. Moreover, fifteen specimens of *Demodex* sp. (3 males, 11 females, 1 nymph) were found, the characteristics of which correspond to the description of an unknown demodecid species provided by Bukva and Preisler [3] (Fig. 3). All specimens were found in the same skin fragment of the nose regions.

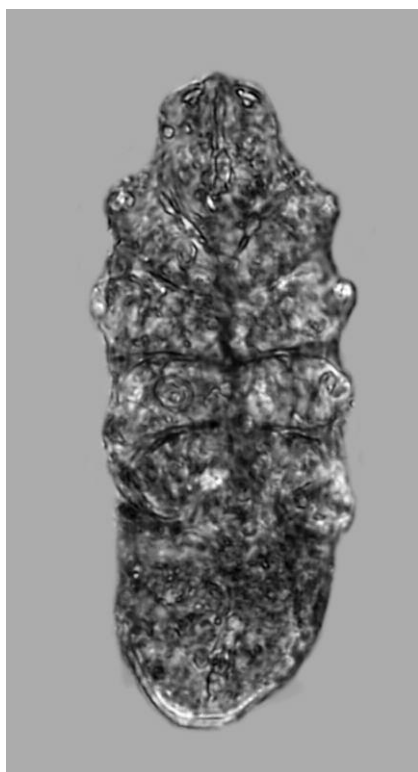
The total prevalence of infestation by *Demodex* spp. in red deer was 63.3%, with the mean intensity of 61 specimens (Table 3).

Discussion

The status of demodectic mites from the Old World deer used to raise doubts. At first, one species, specific to this group, was known, *Demodex cervi*, described from *Rusa unicorn*

(=*Cervus unicorn*) and sometimes attributed to other hosts of this group [11]. Next, *D. pseudaxis* from *Cervus nippon* was described [12]; however, it is known from only single finding and there is no precise documentation or museum materials. The detailed description of the demodectic mite from the Austrian red deer, together with symptoms of infestation, was presented by Kutzer and Grünberg [11]; it was identified, however, as *D. cervi*. Bukva [6] described this form as *D. kutzeri* and proved its occurrence in red deer from the Czech Republic and Sika deer from the zoological garden in Berlin.

The other demodectic mite described from the red deer, *Demodex acutipes*, was recorded only once – in the Czech Republic [3] – and was considered a rare species [9]. It was not recorded in the previously studied more than two hundred red deer in northern Poland [4], in which *D. kutzeri* was frequently found (prevalence 13%, mean intensity 21.3). At present, it was found in 20.0% of the red deer, but it was characterised by lower parameters of infestation compared with *D. kutzeri* [53.3%].

Fig. 1. *Demodex acutipēs*Fig. 2. *Demodex kutzeri*Fig. 3. *Demodex* sp. (female and male)

Perhaps low infestation parameters are correlated with a more limited location – demodectic mites were being found only in the head regions, while *D. kutzeri* occurs in hair follicles of different regions of the body [1,4]. Location is probably related to the mechanism of transmission, which in turn defines the frequency of occurrence [13].

Whereas *Demodex* sp., previously recorded by Bukva and Preisler [3], and at present confirmed in the red deer, is characterised by distinct traits compared with other representatives of the genus *Demodex* and is probably a separate species. This requires, however, verification based on a representative number of specimens.

Table 3. Occurrence of *Demodex* spp. in red deer (N=30)

Species of <i>Demodex</i>	Prevalence %	Number of specimens*	Mean intensity [specimen]*	Range of intensity*	Localization in skin
<i>D. acutipēs</i>	20.0	27	4.5	1-6	head: eyelids and eye region, chin
<i>D. kutzeri</i>	53.3	1117	69.8	2-242	mostly head: eyelids and eye chin, nose
<i>Demodex</i> sp.	6.7	15	7.5	6-9	head: nose
Total	63.3	1159	61.0	1-242	–

* number of specimens of demodectic mites found in infested skin fragments (based on the examination of the skin biopsies of the eleven regions of the body)

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