

Original papers

The occurrence of *Demodex kutzeri* Bukva, 1987 (Acari, Demodecidae) in red deer (*Cervus elaphus* L.) in Poland

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ABSTRACT. The occurrence of *Demodex kutzeri* Bukva, 1987 was examined and compared in red deer coming from different populations – 25 red deer from northern Poland (Masurian Lake District) and 25 from southern Poland (Lower Silesia). The total prevalence of infestation in red deer by *D. kutzeri* was 52% with the mean intensity of 38 individuals and the intensity range of 1–135. Parameters of infestation for red deer from northern Poland were much higher (68%, 49), while for other red deer – lower (36%, 16). Demodectic mites *D. kutzeri* are associated with common hair follicles, therefore they can be found in different parts of the body, however most of the specimens were found in the head skin. Regardless of the location and the infestation rate (including density of mites in the skin), infestations were not accompanied by symptoms of demodecosis.

Key words: *Demodex kutzeri*, demodectic mites, red deer, *Cervus elaphus*

Introduction

Mites from the family of Demodecidae are usually characterized by high host specificity. Monoxenic species dominate over only a few oligoxenic ones. And thus, *Demodex nanus* Hirst, 1918, common in the brown rat *Rattus norvegicus* (Berkenhout, 1769) [1–4], was also found in the black rat *Rattus rattus* (Linnaeus, 1758*)* [1,5]. Whereas *Demodex sabani* Desch, Lukoschus and Nadchatram, 1984 – basically monoxenic species associated with ungulates – was found in seven species of Asian rodents from the family of Muridae [6]. Demodecids related to hoofed animals are generally monoxenic [7]. But *Demodex odocoilei* Desch et Nutting, 1974, described from the white-tailed deer *Odocoileus virginianus* (Zimmermann, 1780) in North America, was later found in other American cervids, i.e. in various subspecies of *O. hemionus* (Rafinesque, 1817) [8–12].

In all cases, however, demodectic mites were found in different host species occurring in the same geographic region. Data on the incidence of the same species from the genus *Demodex* in different species of wild mammals on other continents refer only to *Demodex kutzeri* Bukva, 1987 (=*D. cervi* sensu Kutzer et Grünberg 1972). The first information about this species was related to observations of demodecosis in red deer *Cervus elaphus* Linnaeus, 1758 in Austria [13], although the species description was based on specimens obtained from the host occurring in the Czech Republic [14]. Also in Poland the species was recorded in red deer [15–17], as well as in roe deer *Capreolus capreolus* Linnaeus, 1758 and in Eurasian elk *Alces alces* Linnaeus, 1758 [15,18]. In addition, it was found in Sika deer *Cervus nippon pseudaxis* Temminck, 1838 from the zoological garden in Berlin [14]. It seems interesting, however, that *D. kutzeri* was also found in cervids from North America – in the Rocky Mountain elk *Cervus elaphus nelsoni* Bailey, 1935 (=*C. canadensis nelsoni* Batley, 1945), but also in representatives of the other Cervidae subfamily – Rocky Mountain mule deer *Odocoileus hemionus hemionus* (Rafinesque, 1817) and white-tailed deer *O. virginianus* [19].

Materials and Methods

The analyzed material consisted of skin samples collected from 50 European red deer *Cervus elaphus*, including 25 red deer from northern Poland (Masurian Lake District), and the material was collected in the winter season of 2012; the other 25 red deer came from southern Poland (Lower Silesia) – 17 red deer examined in winter 2008 and 8 in September 2012. The red deer came from the shooting (culling) conducted by hunters and were obtained from game purchasing centers.

To examine the presence of skin mites, skin samples of the area of 4 cm^2 were collected from the head (eyelids, auricle, lips, nose), legs and genital regions, and then fixed in 70% ethanol solution. The samples were examined using the method of digestion and decantation [20]. Specimens of mites were examined under an optical microscope using the phase-contrast technique, and permanent preparations in Faure's solution were made.

Results

In total, 979 specimens of *Demodex kutzeri* were found in 26 of 50 studied red deer; including 291 females, 141 males, 203 nymphs, 101 protonymphs, 98 larvae and 145 eggs (Table 1, Figs 1,2). Most of the specimens came from the head skin. Higher parameters of infestation were determined for the red deer from the northern part of the country – the prevalence of infestation was 68%, with the mean intensity of 49 individuals and the intensity range of 1–135. In the case of the red deer from the southern part of the country, the prevalence was 36%, with the mean intensity of 16 individuals and the intensity range of 1–25 (Table 2). Infestations were asymptomatic – no skin lesions typical of the demodecosis image were observed.

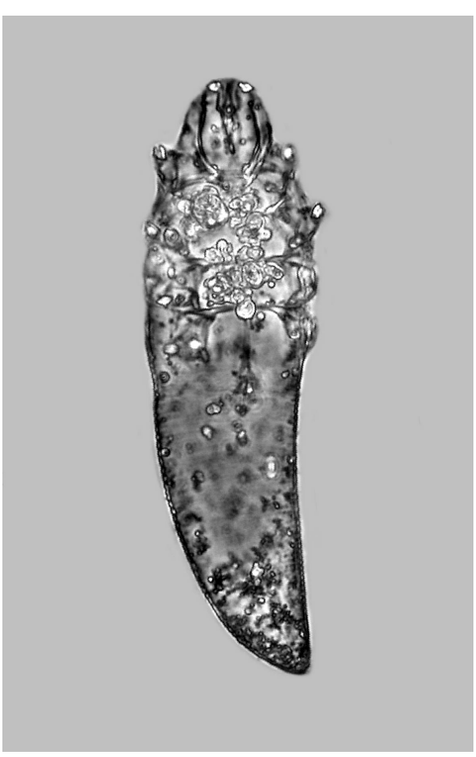

Fig. 1. *Demodex kutzeri*, female

Fig. 2. *Demodex kutzeri*, egg

Discussion

As evidenced by the performed comparison, the infestation rate by *Demodex kutzeri* varies in the red deer. Higher parameters were obtained for the red deer from northern Poland. However, much lower infestation parameters were observed in the previous research conducted in this area – the prevalence ranged from 12 to 13% [15,16]. *Demodex kutzeri* is a demodectic mite associated with hair follicles, which is transmitted by direct contact between hosts. Therefore, the infestation rate (prevalence) in a host population may depend both on the population density and interindividual transmission opportunity, which is related to biology and behavior of hosts [21]. Thus, it varies both in the populational terms, as well as in terms of age groups or sex, and it may also be affected by seasonal changes [15]. It is difficult, however, to compare the current data from Poland with

Table 1. Body size (means, ranges, standard deviations, in μm) of adult stages of *Demodex kutzeri* from Poland compared with the data by Bukva [14]

	Present		**Bukva [14]**	
	Male N=20	Female N=20	Male N=20	Female N=20
Length of gnathosoma	28.9 SD=2.3	31.8 SD=3.5	25.5 SD=1.0	31.5 SD=1.3
Width of gnathosoma (at base)	32.3 SD=2.4	33.4 SD=3.5	30.0 SD=1.6	32.5 SD=2.1
Length of podosoma	65.9 SD=4.8	67.2 SD=7.6	64.7 SD=5.1	66.8 SD=3.0
Width of podosoma	66.7 SD=3.4	65.1 SD=6.0	68.3 SD=6.9	69.4 SD=4.2
Length of opisthosoma	119.2 SD=6.9	138.7 SD=9.8	126.0 SD=12.0	144.2 SD=14.1
Width of opisthosoma	62.33 SD=3.8	60.6 SD=5.5	66.9 SD=4.3	63.0 SD=6.5
Length of aedeagus	32.9 SD=1.2	–	32.6 SD=2.7	–
Length of vulva	–	10.3 SD=0.8	–	10.7 SD=0.6
Total length of body	213.6 SD=5.7	237.6 SD=11.4	216.1 SD=13.9	242.5 SD=15.2

infestation of red deer from other regions of its occurrence, since there are no relevant observations available. Only Bukva [14] reported that per 21 heads of red deer from the Czech Republic examined for the presence of *D. kutzeri*, demodectic mites were present in the skin of six red deer, i.e. nearly 29%. Whereas in the previous research from the territory of Poland, *D. kutzeri* was characterized by higher parameters of infestation in red deer (prevalence 13%, mean intensity 21.3), as compared to roe deer (5%, 18) or Eurasian elk (3%, 12) [15,16,18]. Perhaps red deer is a typical host of this parasite, and it occurs less frequently in other representatives of this group of mammals. Nonetheless, the status of *D. kutzeri* forms from other hosts requires further clarification. According to Desch et al. [19], methods of demodectic mites transmission between hosts largely reduce the interspecific transfer. Thus similar morphological forms of demodectic mites living in hair follicles of different cervids may be a consequence of stable conditions of their microhabitat, which have not changed significantly during the process of host speciation.

Whereas the infestation prevalence is often associated with the condition of hosts, and the high intensity and high density of mites in the skin may be followed by the development of demodecosis [21]. No skin lesions associated with the skin colonization by *D. kutzeri* were observed in the present research, although relatively large numbers of demodectic mites were observed locally in skin samples collected from the head regions. This seems interesting in the context of demodecosis descriptions resulting from the presence of *D. kutzeri*, not only in the red deer [13], but also in American Cervidae [19].

Also observations of *D. kutzeri* topography in

Table 2. Occurrence of *Demodex kutzeri* in red deer (N=50)

	Prevalence [%]	Number of specimens	Mean intensity [specimen]	Range of intensity	Localization in skin
North Poland [N=25]	68	835	49	1 – 135	head
South Poland [N=25]	36	144	16	1 – 25	head
Total	52	979	38	1 – 135	head

the red deer skin provided some significant data. This demodectic mite is associated with common hair follicles, thus it can occur in different parts of the body covered with hair. Whereas both in the current and in the previous observations [15], *D. kutzeri* was found mostly in the head skin. Typically, Demodecidae have strong topographic preferences determined both by topical specificity, and methods of transmission between hosts. In this case, the topography may be determined by the transfer mechanism related to the host behavior, including social behavior [4,22].

References

[1] Hirst S. 1919. Studies on Acari. No 1. The genus *Demodex*, Owen. British Museum Natural History, London.

[2] Izdebska J.N. 2012. A new Demodecidae species (Acari) from the yellow-necked mouse *Apodemus flavicollis* (Rodentia, Muridae) – description with data on parasitism. *Journal of Parasitology* 98: 1101-1104.

[3] Izdebska J.N., Rolbiecki L. 2012. Demodectic mites of the brown rat *Rattus norvegicus* (Berkenhout, 1769) (Rodentia, Muridae) with a new finding of *Demodex ratticola* Bukva, 1995 (Acari, Demodecidae). *Annals of Parasitology* 58: 71-74.

[4] Izdebska J.N., Rolbiecki L. 2012. Topical structure and topography of *Demodex* spp. (Acari, Demodecidae), in brown rat *Rattus norvegicus* (Rodentia, Muridae). In: *Arthropods. The medical and economic importance*. (Eds. A. Buczek, C. Błaszak). Akapit, Lublin: 133-141.

[5] Desch C.E. 1987. Redescription of *Demodex nanus* (Acari: Demodecidae) from *Rattus norvegicus* and *R. rattus* (Rodentia). *Journal of Medical Entomology* 24:19-23.

[6] Desch C.E., Lukoschus F.S., Nadchatram M. 1984. A new demodicid (Acari: Demodicidae) from the meibomian glands of Southeast Asian rats (Rodentia: Muridae). *Tropical Biomedicine* 1: 55-62.

[7] Izdebska J.N. 2009. Selected aspects of adaptations to the parasitism of hair follicle mites (Acari, Demodecidae) from hoofed mammals. *European Bison Conservation Newsletter* 2: 80-88.

[8] Desch C.E., Nutting W.B. 1974. *Demodex odocoilei* sp. nov. from the white-tailed deer, *Odocoileus virginianus*. *Canadian Journal of Zoology* 52: 785-789.

[9] Jacques C.N., Jenks J.A., Hildreth M.B., Schauer R.J., Johnson D.D. 2001. Demodicosis in a white-tailed deer (*Odocoileus virginianus*) in South Dakota. *Prairie Naturalist* 33: 221-226.

[10] Turner J.C., Cano J. 2008. Demodectic mange in a white-tailed deer from Walker County, Texas. *Journal of Medical Entomology* 45: 572-575.

[11] Bildfell R.J., Mertins J.W., Mortenson J.A., Cottam D.F. 2004. Hair-loss syndrome in black-tailed deer of the Pacific North west. *Journal of Wildlife Diseases* 40: 670-681.

[12] Gentes M.L., Proctor H., Wobeser G. 2007. Demodicosis in a mule deer (*Odocoileus hemionus hemionus*) from Saskatchewan, Canada. *Journal of Wildlife Diseases* 43: 758-761.

[13] Kutzer E., Grünberg W. 1972. Demodikose beim Rothirsh (*Cervus elaphus*). *Zeitschrift für Parasitenkunde* 40: 9-17.

[14] Bukva V. 1987. *Demodex kutzeri* sp. n. (Acari: Demodicidae), an identical parasite of two species of deer, *Cervus elaphus* and *C. nippon pseudaxis*. *Folia Parasitologica* 34: 173-181.

[15] Kadulski S. 1996. Ectoparasites of Cervidae in north-east Poland. *Acta Parasitologica* 41: 204-210.

[16] Izdebska J.N., Fryderyk S. 2000. *Demodex* spp. (Acari, Demodecidae) in wild Artiodactyla in Poland. *Acta Parasitologica* 45: 163-164.

[17] Izdebska J.N., Fryderyk S. 2012. *Demodex acutipes* Bukva & Preisler, 1988 (Acari, Demodecidae) – a rare parasite of red deer (*Cervus elaphus* L.). *Annals of Parasitology* 58: 161-166.

[18] Kadulski S. 1996. Dalsze badania nad stawonogami pasożytniczymi łosia *Alces alces* w Polsce. *Wiadomości Parazytologiczne* 42: 349-355.

[19] Desch C.E., Andrews J.J., Baeten L.A., Holder Z., Powers J.G., Weber D., Ballweber L.R. 2010. New records of hair follicle mites (Demodecidae) from North American Cervidae. *Journal of Wildlife Diseases* 46: 585-590.

[20] Izdebska J.N. 2004. *Demodex* spp. (Acari: Demodecidae) in brown rat (Rodentia: Muridae) in Poland. *Wiadomości Parazytologiczne* 50: 333-335.

[21] Izdebska J.N. 2010. New data of demodecosis hominis – ethiology, pathogenesis and diagnosis. In: *Arthropods. Ecological and pathological aspects of parasite-host relationships*. (Eds. A. Buczek, C. Błaszak). Akapit, Lublin: 137-145.

[22] Izdebska J.N., Rolbiecki L., Fryderyk S. 2011. New data on distribution of *Demodex huttereri* Mertens, Lukoschus et Nutting, 1983 and topical specificity and topography of demodectic mites in striped field mouse *Apodemus agrarius*. *Wiadomości Parazytologiczne* 57: 261-264.

Received 21 March 2013
Accepted 13 May 2013