European Bison Conservation Newsletter Vol 7 (2014) pp: 89–92

Comparative morphology of ovaries in European moose and European bison

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Abstract: The aim of this study was the morphometric characteristic of European moose ovaries. The following parameters were analyzed: weight, length, width and height. All data obtained in this study were referred to the results of analogous studies performed on European bison as both species belong to order Cetardiodactyla.

The material consisted of 20 ovaries obtained from females of European moose (*Alces alces*) at 4–25 years of age living in north-eastern Poland. All animals were culled in November, i.e. they were in early anestrus or in early pregnancy. All gonads were also examined macroscopically, and the weight and size of each ovary were measured. All results were analyzed statistically.

Comparing the results of measurement of moose ovaries to data of analogous studies on European bison, the correlation between body weight and the weight as well as size of the ovaries can be found.

Key words: *Alces alces*, *Bison bonasus*, ovaries, morphology, morphometry

Majority of data concerning reproductive cycle of moose are obtained from Sweden and Northern America (Alaska). Moose reach sexual maturity at 16–28 months of age (Rausch *et al.* 2008). Estrus cycle lasts 24–25 days according to Franzmann (1981) and according to Schwartz and Hundertmark (1993) 22–28 days. Single estrus lasts 15–26 hours (Franzmann 1981, Schwartz and Hundertmark 1993) and if the cow is not impregnated she will enter estrus again after about 3 weeks (Schwartz 1992). According to Schwartz and Hundertmark (1993) pregnancy in moose lasts 231 days, however other authors reported 240 days (8 months). The percentage of twins pregnancies in moose is equal to 10–75% and it is higher than in other wild ruminant species (Rausch *et al.* 2008).

By the end of XX century the population of moose in Poland was very small. To recover this population the moratorium on hunting within the whole territory of Poland has been introduced in 2001. At the end of 2009, moose population has significantly increased and excessive damages especially in young forests were recorded. Therefore the rate of moose reproduction has become very important issue. The following problem has been raised: how to stabilize the moose population in Poland

and simultaneously do not endanger its existence. In 2010 under the framework of "The strategy for moose protection and management in Poland" the permission of Minister of Environment was obtained (DL. decision Gł-6713–5/4539L/10/PJ of 20.09.2010) to conduct the relevant analyses. This is the first time when such research was undertaken. This analysis was a part of detailed morphometric study of female genital organs in moose species. Knowledge obtained through this project can allow for more rational management of moose population in Poland. Because moose belong to order Cetardiodactyla as well as for verification purposes all results obtained in this study were referred to the analogous studies performed in previous years on European bison.

Materials and Methods

The material consisted of 20 ovaries obtained from females of European moose (*Alces alces*) culled in north-eastern Poland. The age of females was estimated between 4 and 25 years, based on the state of dentition (Hindelang, Peterson 1994). Taking into account that moose reach sexual maturity at 16–28 months of age (Rausch *et al*. 2008), all females fully completed the process of puberty. Because all individuals were culled in November, we assume that they were in early anestrus or in early pregnancy.

Immediately after culling all animals were weighed with an accuracy of ± 3 kg. Once the ovaries had been isolated, their total length, width and height was measured using an electronic slide caliper exact to 0.01 cm. Moreover all gonads were weighted with an accuracy of 0.01 gram with the electronic scale. The macroscopic evaluation of examined ovaries included presence of ovarian follicles and *corpora lutea*.

The relative ovaries weight i.e. the percentage of ovaries weigh (OW) compared to body weigh (BW): $I_1 = (OW/BW) \times 100$ was determined in each case. All results were analyzed statistically.

All results obtained in this study were referred to results of study conducted on 19 sexually mature females of lowland European bison (*Bison bonasus*) at the age of 2–20 years from the Białowieża Forest (Olbrych 2008). Lowland European bison is the only one wild ruminant species in Poland on which such morphometrical studies were undertaken.

Results and Discussion

The right ovary's mean dimensions (length × width × height) were: 2.43 × 1.66 × 1.12 cm. Left ovary was significantly larger and its parameters were: 2.54 × 1.71 × 1.24 cm, respectively. Both moose gonads were smaller than bison's ovaries. In this species, the right ovary's mean dimensions (length × width × height)

were: 2.72 × 1.92 × 1.32 cm. The size of left ovary was equal or slightly larger: 2.73 × 1.87 × 1, 36 cm, respectively (Tabl. 1).

Table 1. Dimensions of moose and European bison ovaries [cm].

		Right ovary			Left ovary		
		Lenght	**Width**	**Height**	**Lenght**	**Width**	**Height**
Moose	mean	2.43	1.66	1.12	2.54	1.71	1.23
	sd.	0.50	0.33	0.26	0.42	0.34	0.31
European bison	mean	2.72	1.92	1.32	2.73	1.87	1.36
	sd.	0.96	0.46	0.47	0.77	0.49	0.39

Mean weight of moose ovaries was 3.29 g and 3.6 g for right and left ovary, respectively (Tabl. 2). The mean relative weigh of both ovaries was 0.0033% (Tab. 3). Weight of both ovaries in moose was lower than in adult female bison group (Tabl. 2) as well as the variability of this parameter was lower for moose (Tabl. 2). The average relative weight of both E. bison's ovaries was significantly higher (by 0.0027%) than in moose (Tab. 3). Obviously the higher relative weight of bison ovaries results from their greater body weight.

Table 2. Mass of moose and bison ovaries (g).

	Right ovary		Left ovary	
	mean	**sd.**	**mean**	**sd.**
Moose	3.29	1.57	3.61	1.47
European bison	5.94	4.02	5.12	2.87

Table 3. Relative weight of moose and bison ovaries (%).

	mean	**sd.**
Moose	0.0033	0.0012
European bison	0.0027	0.0011

In E. bison similarly to domestic ruminants the right ovary is heavier and slightly larger then the left one (Bielański, Tischner 1997; Olbrych 2008). It is probably related to its localization adjacent to rumen. Surprisingly, in examined group of moose females left ovary has been larger and heavier. It is difficult to explain this phenomenon. It can result from smaller size of moose rumen which do not limit left ovary so considerably like in other ruminants. Other explanation would be slightly different localization of abdominal organs in moose compared to other ruminant species.

Conclusions

Moose ovaries were significantly smaller than bison gonads, which is an obvious consequence of differences in size and body weight of both species. However, in moose, there was a significant disproportion in the weight as well as the size of both ovaries. The left gonad was larger and heavier. It may result in increased hormonal activity of left ovary. Size of both ovaries was comparable to those in analysed group of female E. bison. All examined parameters (length, width and height) differed only slightly between right and left bison's ovary. This leads to the conclusion that in European bison level of hormonal activity as well as number of ovulations of both ovaries are comparable.

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Morfologia porównawcza jajnika żubra i łosia

Streszczenie: Celem niniejszej pracy było opisanie parametrów makroskopowych jajników łosia europejskiego, ze szczególnym uwzględnieniem ich masy i wymiarów. Wyniki porównano do danych pochodzących od samic żubra, ponieważ oba gatunki należą do tego samego rzędu parzystokopytnych.

Grupę badaną stanowiło 20 samic łosia w wieku od 4 do 25 lat, głównie z terenów północno-wschodniej Polski. Zwierzęta pozyskano w listopadzie, co pozwala przypuszczać, iż znajdowały się one w okresie wczesnego anestrus lub w początkowym etapie ciąży. Od samic pobrane zostały jajniki, które następnie zmierzono i zważono, a także dokonano oceny makroskopowej. Pomiary zostały poddane analizie statystycznej.

W wyniku porównania uzyskanych parametrów jajników łosia do żubra europejskiego można stwierdzić korelację między wielkością zwierzęcia a masą i wymiarami jajników.