



Short Communication

Basic Morphometric Characteristics of Mouflon Trophies (*Ovis orientalis* Gmelin, 1774)

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ABSTRACT

Study was conducted on a sample consisting of 38 mouflon horns from hunting grounds in Serbia. The parameters that were analyzed (length of the left horn, length of the right horn, circumference of the horns, spread of the horns, color of the horns, ring and curvature) were measured according to the propositions adopted by the The International Council for Game and Wildlife. The aim of the paper was to determine the absolute and mean values of the length of the left horn and of the right horn, the circumference of the horns, span of the horns, annularity and curve of the horns, as well as the existence of mutual dependence between certain parameters of mouflon trophies. Using the method of descriptive statistics, the mean values of the length of the left and right horns were obtained. Results showed that the right horn was slightly more developed in the observed population. Namely, the mean value of the length of the right horn is larger, while the mean values of the circumference of the left and right are almost the same. The results of Pearson's correlation showed a statistically significant positive correlation between certain morphometric parameters of the horns, such as the length of the horns and the circumference of horn in the second and in the third third distance from the base. A positive correlation was also observed between curvature of horns and circumference in the first and second thirds, as well as between curvature of horns and horn span.

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Authors' Contribution

UM and MM collected data and observed parameters. MR, DP and MM processed the data and performed statistical analysis. UM interpreted the results.

Key words

Mouflon, Horns, Morphometry, Trophy, Morphometric characteristics

Mouflons belong to the genus of sheep (*Ovis*). They are wild sheep. The evolution of wild sheep had been moving in two directions. One group is R-strategy, the other is K-strategy. Mouflons, along with argals and urials, had an evolutionary course in the R strategy. In contrast, the K strategy is characteristic of American snow sheep. The main feature of the R strategy is a high level of productivity, but the lifespan of individuals is not particularly long. In contrast to this direction, the groups that developed in the K strategy have a longer lifespan, but their reproductive

potential is weaker (Urošević *et al.*, 2017).

In taxonomic classification of mouflon, certain contradictions can be found. Some authors classify all mouflons, European and Asian, in *Ovis orientalis*. Unlike them, other researcher classify Asian mouflons as *Ovis orientalis*, but the European one as *Ovis musimon*. The official book of zoological names - ICZN (Official List of Specific Names in Zoology) lists the mouflon as *Ovis orinetalis* Gmelin, 1774. Piegert, Uloth (2000, cit. in Obretenov, 2010) state that orientalis is a synonym for "musimon" which shows that the systematics of the mouflon is not unique and definitely resolved.

Mouflon used to live on the entire territory of continental Europe. Due to irrational and excessive hunting, it disappeared from Europe in the period 3,000-4,000 years ago (Urošević *et al.*, 2017). Thanks to the isolation of the Mediterranean islands, mouflon did not been disappear in Europe completely. Mouflons dd arrived from the Mediterranean islands to the continental part of Europe in 1730 (Santiago-Moreno *et al.*, 2004; Barbato,

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2016). Then Prince Eugene of Savoie (Eugene de Savoie Carighan) imported several specimens from the island and placed them in the “Belvedere” zoo near Vienna (Cassinello, 2012). From there, mouflons were gradually transferred to other destinations.

Mouflon are characterized by strong horns, which are constantly growing, and represent an interesting hunting trophy. Only males have horns, although it is possible for females to have horns as well. Horns belong to the homonymous type of horns. Garaj and Gašparnik (1997) report that at the age of 5 years the average horn length is 63.5 cm, at 7 years it is 71.2 cm, at 8 years this value is 77.3 cm and at 9 years the average value of horn length mouflon is 79.8 cm. The average value of the circumference at the first third of the length, at the age of 5 years, is 22.6 cm, at 6 years it is 23.2 cm, at 7 years it is 23.0 cm. At the age of 8, the average circumference in the first third distance from the base is 21.7 cm, and at the age of 8, it is 22.7 cm. The circumference of the horn in the second third distance from the base, at the age of 5 years, was 21.0 cm, at 6 years 21.8 cm, at 7 years 21.3, at 8 years it is 20.3 cm, and at 9 years that value is 21.5 cm. When it comes to the average value of the horn circumference in the third distance from the base, at 5 years it was 16.5 cm, at 6 years 17.6 cm, at 7 years 17.8 cm. With the age under 7 years, that value was 16.9 cm, and with 8 years, 18.4 cm.

Macha (1995) states that at the age of 18-21 months, the circumference in the first third distance from the base is 20.0 cm, and the length of the horn is 50.0 cm. At the age of 30-33 months, the circumference in the first third is 23.0 cm, and the length is 70.0 cm. Mouflons aged 42-45 months have a girth at the first third of 24.0 cm, and a length of 78.0 cm. Čević (1953) states that the horns can grow to a length of 85-90 cm. Raguž *et al.* (1994) state that the average value of the circumference in the first third distance from the base, at the age of five, is 25.21 cm. At 6 years old, that value is 25.20 cm. The circumference of the horn in the second third distance from the base, at the age of 5, is 23.49 cm. At the age of 6, this value is 23.34 cm. According to the authors, the circumference in the third distance from the base is 19.08 cm at the age of 5, and 18.99 at the age of 6.

Material and methods

For the purposes of this work, the morphometric parameters of the horns of male mouflon shot on hunting grounds in Serbia were analyzed. The study was conducted on a sample consisting of 38 horns. The data was taken from the official CIC Mouflon horn grading forms. Evaluation was done by authorized CIC experts, and confirmation was done at official hunting trophy exhibitions. The parameters that were analyzed were measured according to the

propositions adopted by the CIC, the International Council for Game and Wildlife. Observed parameters were length of the left horn, length of the right horn, circumference of the left and right horn (the circumference in the first third distance from the base, the circumference in the second third distance from the base, the circumference in the third distance from the base), span of the horns, color of the horns, annularity and curve of the horns. The data were first processed using the method of descriptive statistics, then the Pearson correlation method was used to determine the dependence between the observed parameters. The collected data were processed with the Statistical Package for the Social Sciences (SPSS) for Windows Release 17.0.0 software.

Results

The lengths of the left horn range from 60 cm to 102.5 cm, and the lengths of the right horn range from 60.7 cm to 100.5 cm. Using the method of descriptive statistics, the mean values of the length of the left horn 78.80 ± 8.60 cm, and the length of the right horn 79.04 ± 8.03 cm (SD), were obtained (Table I).

Table I. Descriptive statistical indicators for horn lengths.

		The length of the left horn	The length of the right horn
N	Valid	38	38
	Missing	0	0
Mean		78.79	79.03
Std. error of mean		1.395	1.30
Std. deviation		8.60	8.03
Variance		74.00	64.61
Skewness		0.22	0.25
Std. error of skewness		0.38	0.38
Kurtosis		0.54	0.94
Std. error of kurtosis		0.75	0.75
Range		42.50	39.80
Minimum		60.00	60.70
Maximum		102.50	100.50

The circumference at the beginning of the first third of the left horn ranges from 20.5 to 25.8 cm, at the beginning of the second third from 19.7 to 24.7 cm and at the beginning of the third of the left horn from 14.4 to 21 cm. The circumference at the beginning of the first third of the right horn ranges from 19.6 cm to 25.5 cm, at the beginning of the second third from 20 cm to 25 cm

Table II. Descriptive statistical indicators for horn circumferences.

		1 st third left horn	1 st third right horn	2 nd third left horn	2 nd third right horn	3 rd third left horn	3 rd third right horn
N	Valid	38	38	38	38	38	38
	Missing	0	0	0	0	0	0
Mean		23.46	23.40	22.33	22.37	17.66	17.70
Std. deviation		1.20	1.34	1.23	1.24	1.70	1.74
Variance		1.44	1.79	1.53	1.55	2.90	3.05
Skewness		-.28	-.79	-.16	-.10	.14	.36
Std. error of skewness		.38	.38	.38	.38	.38	.38
Kurtosis		-.02	.93	-.70	-.54	-.49	.29
Std. error of kurtosis		.75	.75	.75	.75	.75	.75
Range		5.30	5.90	5.00	5.00	6.60	8.30
Minimum		20.50	19.60	19.70	20.00	14.40	14.00
Maximum		25.80	25.50	24.70	25.00	21.00	22.30

and at the beginning of the third of the right horn from 14 cm to 22.3 cm. Using the method of descriptive statistics, the mean values of the circumference at the beginning of the first third of the left horn were obtained 23.46 ± 1.20 cm (Mean \pm SD) the circumference at the beginning of the first third of the right horn 23.40 ± 1.34 cm, the girth at the beginning of the second third of the left horn 22.33 ± 1.23 cm, the girth at the beginning of the second third of the right horn 22.37 ± 1.24 cm, the circumference at the beginning of the third third of the left horn 17.66 ± 1.70 cm and the girth at the beginning of the third of the right horn 17.70 ± 1.74 cm (Table II).

Table III. Descriptive statistical indicators for other characteristics of horns.

		Span of horns	Horn color	Annularity	Curvature
N	Valid	38	38	38	38
	Missing	0	0	0	0
Mean		47.02	2.21	2.52	4.47
Std. Deviation		3.54	.65	.44	.95
Variance		12.54	.42	.20	.90
Skewness		1.16	-.62	-.34	-1.71
Std. error of skewness		.38	.38	.38	.38
Kurtosis		2.41	-.13	-1.14	1.74
Std. error of kurtosis		.75	.75	.75	.75
Range		17.05	2.5	1.5	3.0
Minimum		41.85	.5	1.5	2.0
Maximum		58.90	3.0	3.0	5.0

Table III shows descriptive indicators for range, color, annularity and curvature of horns. The mean value of the observed range is 47.02 ± 3.54 (Mean \pm SD) cm, and ranges from 41.85 cm to 58.90 cm. Horn color is graded from 0 to 3 points, so the darkest horns get the maximum number of points. Annularity of the horns is also evaluated from 0 to 3 points. Table III shows that, on average, the horns received 2 points for color and 2.5 for annularity. The curvature of the horns is evaluated from 0 to 5 points, and the average value of the observed horns is 4.47 points.

The results of Pearson's correlation showed a statistically significant positive correlation between certain morphometric parameters of the horns. Supplementary Table I shows significant statistical positive correlation between the lengths of the left and right horns and the circumference in the second and third thirds.

Supplementary Table II shows the correlations between the remaining mouflon trophy evaluation parameters. A statistically significant positive correlation was observed between curvature and circumference in the first and second thirds, as well as between curvature and horn span.

Conclusion

The results of the research showed the absolute and mean values of the length of the left horn and the right horn, the circumference of the horns, the range of the horns, annularity and curvature of the horns, but also the existence of mutual dependence between certain parameters of mouflon trophies. Using the method of descriptive statistics, the mean values of the length of the left and right horns were obtained, and it was determined that the right horn

was slightly more developed in the observed population. Namely, the mean value of the length of the right horn is larger, while the mean values of the circumference of the left and right are almost the same. The results of Pearson's correlation showed a statistically significant positive correlation between certain morphometric parameters of the horns, such as the length of the left and right horns and the circumference in the second and third distance from the base. A positive correlation was also observed between curvature and circumference in the first and second thirds, as well as between curvature and horn span.

Supplementary material

There is supplementary material associated with this article. Access the material online at: <https://dx.doi.org/10.17582/journal.pjz/20220711150759>

Statement of conflict of interest

The authors have declared no conflict of interest.

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Supplementary Material

Basic Morphometric Characteristics of Mouflon Trophies (*Ovis orientalis* Gmelin, 1774)

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Supplementary Table I. Correlations between measured trophy elements.

		Left horn length	Right horn length	1 st third left horn	1 st third right horn	2 nd third left horn	2 nd third right horn	3 rd third left horn	3 rd third right horn
Left horn length	Pearson correlation	1	.936**	.376*	.316	.605**	.614**	.652**	.760**
	Sig. (2-tailed)		.000	.020	.053	.000	.000	.000	.000
	N	38	38	38	38	38	38	38	38
Right horn length	Pearson correlation	.936**	1	.399*	.353*	.593**	.585**	.713**	.726**
	Sig. (2-tailed)	.000		.013	.030	.000	.000	.000	.000
	N	38	38	38	38	38	38	38	38
1 st third left horn	Pearson correlation	.376*	.399*	1	.967**	.813**	.793**	.507**	.522**
	Sig. (2-tailed)	.020	.013		.000	.000	.000	.001	.001
	N	38	38	38	38	38	38	38	38
1 st third right horn	Pearson correlation	.316	.353*	.967**	1	.773**	.784**	.461**	.473**
	Sig. (2-tailed)	.053	.030	.000		.000	.000	.004	.003
	N	38	38	38	38	38	38	38	38
2 nd third left horn	Pearson correlation	.605**	.593**	.813**	.773**	1	.942**	.702**	.789**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000
	N	38	38	38	38	38	38	38	38
2 nd third right horn	Pearson correlation	.614**	.585**	.793**	.784**	.942**	1	.623**	.771**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000
	N	38	38	38	38	38	38	38	38
3 rd third left horn	Pearson correlation	.652**	.713**	.507**	.461**	.702**	.623**	1	.870**
	Sig. (2-tailed)	.000	.000	.001	.004	.000	.000		.000
	N	38	38	38	38	38	38	38	38
3 rd third right horn	Pearson correlation	.760**	.726**	.522**	.473**	.789**	.771**	.870**	1
	Sig. (2-tailed)	.000	.000	.001	.003	.000	.000	.000	
	N	38	38	38	38	38	38	38	38

*, correlation is significant at the 0.05 level (2-tailed); **, correlation is significant at the 0.01 level (2-tailed).

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Supplementary Table II. Correlations between individual measured trophy elements.

		1. Trećina levi rog	1. Trećina desni rog	2. Trećina levi rog	2. Trećina desni rog	Raspon rogova	Zakrivl- jenost
1 st third left horn	Pearson correlation	1	.967**	.813**	.793**	.238	.461**
	Sig. (2-tailed)		.000	.000	.000	.150	.004
	N	38	38	38	38	38	38
1 st third right horn	Pearson correlation	.967**	1	.773**	.784**	.238	.462**
	Sig. (2-tailed)	.000		.000	.000	.150	.003
	N	38	38	38	38	38	38
2 nd third left horn	Pearson correlation	.813**	.773**	1	.942**	.399*	.551**
	Sig. (2-tailed)	.000	.000		.000	.013	.000
	N	38	38	38	38	38	38
2 nd third right horn	Pearson correlation	.793**	.784**	.942**	1	.377*	.507**
	Sig. (2-tailed)	.000	.000	.000		.020	.001
	N	38	38	38	38	38	38
horns span	Pearson correlation	.238	.238	.399*	.377*	1	.589**
	Sig. (2-tailed)	.150	.150	.013	.020		.000
	N	38	38	38	38	38	38
curvature	Pearson correlation	.461**	.462**	.551**	.507**	.589**	1
	Sig. (2-tailed)	.004	.003	.000	.001	.000	
	N	38	38	38	38	38	38

*, Correlation is significant at the 0.05 level (2-tailed); **, Correlation is significant at the 0.01 level (2-tailed).