Phenotypic Differences Estimation between the Sexes of the *Romanian Mioritic Shepherd* Breed

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Abstract
Romanian Mioritic Shepherd Dog was selected from a natural population breed of the Romanian Carpathian Mountains. The aim of this study was the evaluation of the phenotypic differences between the sexes in a population of 26 males and 23 females of the Mioritic Shepherd Dog breed, for 9 body measurements: height at elbow, height at hock, head length, skull length, skull width, muzzle length, muzzle width, muzzle depth and muzzle perimeter. Following the study on the significance of statistical differences between body measurements recorded in the evaluated population, it was concluded that males from the people of the Romanian Mioritic Shepherd Dog studied in this paper showed superior and significant values for height at the elbow ($p<0.05$), height at hock ($p<0.05$), head length ($p<0.01$), muzzle length ($p<0.05$). It should be noted that the evaluated females showed superior values compared to males, but insignificant ($p>0.05$), for muzzle width and muzzle depth. We recommend to dog breeders specialists consider the genetic improvement programs, and also our results presented in this paper.

Key words: phenotypic differences, sexual dimorphism, *Romanian Mioritic Shepherd Dog*, males, females, body measurements

1. Introduction

The breeding geneticist is not necessarily interested in how many genes underlie the development of a quantitative character. Their number can only influence the diversity of individuals in a population for the character considered, and less its quantitative expression. He is particularly interested in the quality of the genes he possesses as well as their share of the total genes that determine him [1].
In developing and optimizing genetic breeding programs for a particular population of animals, it is important that in addition to the genetic parameters of the targets for selection characters, to know the existence and size of sexual dimorphism. Sexual dimorphism for a certain character is given by the differences in phenotypic expression in the two sexes, male and female [1].
In dogs, as well as in other animal species, the external appearance of the body is one of the basic criteria for selection. By assessing the external appearance of the body, the researchers can obtain information for breed affiliation, the degree of breed improvement compared to its standard, the presence of defects that reduce the biological value of animals, the animal health status, and how was carried out the growth and development until to that stage.

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In a complex and full assessment of dogs, the health status of animals, appetite, temperament, behavior towards neighboring animals and also to the examiner, the skills, origin, and transmission of useful qualities at descendants are very important [2].

It is recognized that the phenotypic value of one character the isolated individuals or one population is the consequence, in the first place, of the type of gene (additive or non-additive), quality, and their combination (genotypes), as well as of interaction which it realizes genes with the environment where the animals develop and perform [1].

If known phenotypic value of a character in a population and its variance, in this case, by special statistical methods, it can estimate the value of additive genetic variance, non-additive and environmental variance, of that population. An estimate of additive and non-additive genetic variance suggests "genetic reserves" existing in the population and it can focus us on which method to turn our attention to change more effectively the population's genetic structure [1].

The aim of this study was to analyze the existence and size of sexual dimorphism in a population of 26 males and 23 females of the *Mioritic Shepherd Dog* breed, for 9 body measurements: height at elbow, height at hock, head length, skull length, skull width, muzzle length, muzzle width, muzzle depth and muzzle perimeter.

2. Materials and methods

We know from practice that there is a directly proportional correlation between the sexual dimorphism and the heritability of a character, meaning that if the sexual dimorphism is high and the heritability is high too, which means that character is mainly determined by genes with additive interaction.

Romanian Mioritic Shepherd Dog is an excellent shepherd, watch, and company dog, at which breeding is important to remember the factors that contribute to its success [2].

Romanian Mioritic Shepherd Dog was selected from a natural population breed from the Carpathian Mountains, for which reason they are resistant and rustic for feeding and maintenance [3]. The nutrition can be assured with various both animal and vegetal components, and it can be administered as mush or granules.

Romanian Mioritic Shepherd Dog has the ability to adapt to different breeding conditions, which are accepted easily. The dog feels better when is maintained in the yard of the house, where it has enough space to move, play and rest [4].

The somatometry consists of body region measures of the dog, in order to obtain data on the overall animal development and the proportions between different parts of the body [5]. In order to achieve correct body measurements, the dog should be placed on horizontally ground, in an orthostatic position, with body weight uniform distributed on four legs, the head, and the neck with their natural position and direction. The body regions are measured between certain anatomical points of reference, which can be determined relatively easily and that employing the anatomical basis of the respective region [6].

For 26 males and 23 females from *Romanian Mioritic Shepherd Dog*, were measured 9 body measurements: height at elbow, height at hock, head length, skull length, skull width, muzzle length, muzzle width, muzzle depth, and muzzle perimeter.

Analyzing the significance of the statistical differences between the body measurements recorded in the 26 males and 23 females from *Romanian Mioritic Shepherd Dog*, it was possible to establish the existence and size of sexual dimorphism. We considered these criteria very important because if for a quantitative character, the size of the sexual dimorphism is known, the size of the heritability coefficient can be estimated with a certain probability, which gives us indications regarding the type of genes that mainly determines that character and therefore the way of improvement to be followed [1]. The study was completed with recommendations made to the dog breeders for this breed in the development and optimization of genetic improvement programs.

3. Results and discussion

In table 1, we present the statistical differences between the average body measurements recorded for 26 males and 23 females from *Romanian Mioritic Shepherd Dog*, for the 9 studied characters. The test was used to test statistical hypotheses of significance t-Student (Student-Gosset).

Thus, from the analysis of the presented data, it can be observed that if for the height at elbow character, the males achieved an average phenotypic value of 39.27±0.661cm, the females registered a value of 37.25±0.95cm.

Analyzing the 2 average values, it can be observed that the males register an increase of 2.02cm compared to the average values of the females. Expressed in relative values, females make up 94.86% of the average value of males. Also for this character, following the analysis of statistical differences between the two sexes, the conclusion was that males are significantly higher compared to females ($p < 0.05$).

For the second studied character, respectively height at hock, the measurements performed in a population of 26 males and 23 females of the *Mioritic Shepherd Dog* breed, showed a higher average value for males, respectively 20.90±0.284 cm, compared to the females that had an average value of 19.33±0.33cm. In absolute values, this difference was -1.57cm, and in relative values females register 92.49% compared to the average value of males. Applying the t-test of statistical significance for this character, respectively height at hock, the conclusion was that males are significantly higher compared to females ($p < 0.05$).

For the next character, respectively head length, the measurements that we performed showed a superiority of males, respectively 20.90±0.284cm compared to the average value recorded in females, 27.39±0.47cm.

Table 1. The significance of statistical differences between body measurements of 26 males and 23 females from *Romanian Mioritic Shepherd Dog* [cm]

Nr. crt.	Character	Value				Differences between averages		Signification
		Males		Females		Absolute values (cm)	Relative values (%)	
		n	X±Sx	n	X±Sx			
1	Height at elbow	26	39.27±0.661	23	37.25±0.95	2.02	94.86	xx
2	Height at hock	26	20.90±0.284	23	19.33±0.33	1.57	92.49	x
3	Head length	26	29.30±0.391	23	27.39±0.47	1.91	93.48	xx
4	Skull length	26	16.80±0.331	23	15.81±0.48	0.99	94.11	ns
5	Skull width	26	16.73±0.405	23	16.19±0.49	0.54	96.77	ns
6	Muzzle length	26	12.73±0.218	23	11.62±0.25	1.11	91.28	x
7	Muzzle width	26	9.20±0.200	23	9.25±0.25	-0.05	100.54	ns
8	Muzzle depth	26	10.10±0.100	23	10.50±0.00	-0.40	103.96	ns
9	Muzzle perimeter	26	28.40±2.076	23	28.00±0,50	0.40	98.59	ns

- Note: x – significant, xx – very significant, ns – non significant.

In absolute values, the difference was 1.91cm in favor of males and expressed in relative values, there is a value of females compared to males of 93.48%. Also for this character, the significance tests confirmed that males *Romanian Mioritic Shepherd Dog* are significantly superior ($p<0.01$), compared to females from the analyzed population for this character.

The four characters analyzed in the 26 males and 23 females were skull length. For males, the average value of this character was 16.80±0.331 cm, and for females, the average character was 15.81±0.48cm. In absolute values, the difference was 0.99 cm in favor of males (94.11%). Analyzing the differences significant for this character, respectively skull length, we found that they are insignificant ($p> 0.05$).

For the skull width character, males register an increase of 0.54cm compared to the average values of females (96.77%), but applying the statistical test we concluded that for this character, the differences between the individuals of the two sexes are insignificant ($p>0.05$).

For the next character, respectively, muzzle length the measurements that we performed showed a superiority of males, respectively 12.73±0.218cm compared to the average value recorded in females, 11.62±0.25cm. In absolute values, the difference was 1.11cm in favor of males and expressed in relative values, there is a value of females compared to males of 91.28%. Also for this character, the significance tests confirmed that males *Romanian Mioritic Shepherd Dog* are significantly superior ($p<0.05$), compared to females from the analyzed population for this character.

For the seven characters, respectively muzzle width, the measurements performed in a

population of 26 males and 23 females of the *Mioritic Sheperd Dog* breed, showed again a superiority of females, respectively a value of 9.25±0.25cm, compared to the value recorded by males of 9.20±0.200cm. The difference expressed in absolute values was 0.05cm in favor of females, respectively in relative values 100.54% compared to the average value of males. Analyzing the significance of statistical differences, we observed that although females have higher values than males for this character, they are insignificant ($p>0.05$).

For the muzzle depth character, the measurements performed again highlighted the superiority of females, they achieved an average value of 10.50±0.00cm compared to 10.10±0.100cm, as they performed males. In absolute values, the difference was +0.40cm in favor of females, and in relative values 103.96%. Analyzing the significance of statistical differences, we observed that although females have higher values than males for this character, they are insignificant ($p> 0.05$).

The last character studied was the muzzle perimeter. For males, the average value of this character was 28.40±2.076cm, and for females, the average character was 28.00±0,50cm. In absolute values, the difference was 0.40cm in favor of males (females 98.59%). Analyzing the differences in significance for this character, respectively muzzle perimeter, we found that they are insignificant ($p> 0.05$)

4. Conclusions

Following the study on the significance of statistical differences between body measurements recorded in the evaluated population, it was concluded that males from the population of the *Romanian Mioritic Shepherd Dog* studied in this paper showed superior and significant values for height at the elbow ($p<0.05$), height at hock ($p<0.05$), head length ($p<0.01$) and muzzle length ($p<0.05$).

It should be noted that the evaluated males showed superior values compared to females, but insignificant ($p>0.05$), for skull length, skull width, and muzzle perimeter.

It should be noted that the evaluated females showed superior values compared to males, but insignificant ($p>0.05$), for muzzle width and muzzle depth.

We recommend to dog breeders specialists consider the genetic improvement programs, and also our results presented in this paper.

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