Estimation of Sexual Dimorphism in a Population of Dogs of the *Romanian Mioritic Shepherd Dog* Breed

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Abstract
Romanian Mioritic Shepherd Dog, was selected from a natural population breed of Romanian Carpathian Mountains. 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 6 body measurements: ear length, ear width, distance between the ears, distance between the eyes, length hair at withers and metacarpal perimeter. Following the study on the significance of statistical differences between body measurements recorded in 26 males and 23 females, it was concluded that sexual dimorphism is not evident in the population of the *Romanian Mioritic Shepherd Dog* studied in this paper, except the distance between the ears character. Among the other characters, the differences between the individuals of the two sexes are insignificant ($p>0.05$). We recommend to the dog breeders to take into account the genetic improvement programs, and also the results presented in this paper.

Key words: 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.
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

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transmission of useful qualities at descendants are very important [2].
It is recognized that the phenotypic value of one character at the isolated individuals or at 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 develops and performs [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 population and it can focus us on which method to turn our attention to change more effectively the population 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 6 body measurements: ear length, ear width, distance between the ears, distance between the eyes, length hair at withers and metacarpal 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 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 by from a natural population breed from Carpathian Mountains, for which reason they are resistant and rustic for feeding and maintenance [5]. 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 at 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 [5].
The somatometry consists into body regions measures of the dog, in order to obtain the data on the overall animal development and the proportions between different parts of body [6].
In order to achieve correct body measurements, the dog should be placed on horizontally ground, in orthostatic position, with body weight uniform distributed on four legs, the head and 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 [7].
For 26 males and 23 females from *Romanian Mioritic Shepherd Dog*, were measured 6 body measurements: ear length, ear width, distance between the ears, distance between the eyes, length hair at withers and metacarpal 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 determine that character and therefore the way of improvement to be followed [5]. 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 6 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 ear length character, the males achieved an average phenotypic value of 14.83±0.760cm, the females registered a value of 14.50±0.50cm.

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
		Male		Female		Absolute values (cm)	Relative values (%)	
		n	X±Sx	n	X±Sx			
1	Ear length	26	14.83±0.760	23	14.50±0.50	0.33	97.77	ns
2	Ear width	26	13.70±0,660	23	14.5±0.50	-0.80	105.84	ns
3	Distance between the ears	26	14.40±0,244	23	12.50±0.50	1.90	86.81	xx
4	Distance between the eyes	26	8.90±0.100	23	9.00±0,00	-0.10	101.12	ns
5	Length hair at withers	26	12.50±0.449	23	13,50±0.50	-1.00	108.00	ns
6	Metacarpal perimeter	26	16.75±0.250	23	16.75±0.75	0.00	100.00	ns

Analyzing the 2 average values, it can be observed that the males register an increase of 0.33cm compared to the average values of the females. Expressed in relative values, females make up 97.77% of the average value of males. Applying the statistical test, we concluded that for this character, respectively ear length, the differences between the individuals of the two sexes are insignificant ($p > 0.05$).

For the second studied character, respectively ear width, the measurements performed in a population of 26 males and 23 females of the *Mioritic Shepherd Dog* breed, showed a higher average value for females, respectively 14.5±0.50cm, compared to the males that had an average value of 13.70±0.660cm. In absolute values, this difference was 0.80 cm, and in relative values females register 105.84% compared to the average value of males. Applying the t-test of statistical significance for this character, respectively ear width, we concluded that although females have higher values than males, they are insignificant ($p > 0.05$).

For the next character, respectively distance between the ears, the measurements that we performed showed a superiority of males, respectively 14.40±0.244cm compared to the average value recorded in females, 12.50±0.50cm. In absolute values the difference was 1.90cm in favor of males, and expressed in relative values, there is a value of females compared to males of 86.81%. 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.

For the next character, respectively distance between the eyes, 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 9.00±0.00cm, compared to the value recorded by a males of 8.90±0.10cm. The difference expressed in absolute values was 0.10cm in favor of females, respectively in relative values 101.12% 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 length hair at withers character, the measurements performed again highlighted the superiority of females, they achieved an average value of 13.50±0.50cm compared to 12.50±0.449cm, as they performed males. In absolute values the difference was 1.00cm in favor of females, and in relative values 108.00%. 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 metacarpal perimeter. For this character, the average values recorded for both sexes were equal, respectively 16.75 ± 0.25 cm.

4. Conclusions

Following the study on the existence and size of sexual dimorphism in a population of 26 males and 23 females of the *Mioritic Shepherd Dog* breed, for 6 body measurements: ear length, ear width, distance between the ears, distance between the eyes, length hair at withers and metacarpal perimeter, we drew the following conclusions: males of the *Mioritic Shepherd Dog* breed, present superior and significant values compared to females, for the character distance between the ears ($p<0.01$).

For the ear length character, males registers an increase of 0.33cm compared to the average values of females, but applying the statistical test we concluded that for this character, the differences between the individuals of the two sexes are insignificant ($p>0.05$).

Females have higher values than males, but insignificant ($p>0.05$), for ear width, distance between the eyes and length hair at withers.

For the metacarpal perimeter character, the mean values recorded for the two sexes were equal, respectively 16.75±0.25cm.

We recommend to the breeders, that dogs from this breed to take into account in genetic improvement programs the observations presented in this paper.

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