BF-1435
[1-3]

SHORT COMMUNICATION Indian Journal of Animal Research

Partial Results Regarding the Genetic Determinism of Growth Process in a Native Horse Breed using Wither's Height

Marius Maftei[1], Daniela Ianitchi[1], Mihai Pruna[1], Dorel Dronca[2]

10.18805/IJAR.BF-1435

ABSTRACT

Study of variability in domestic animal populations is the foundation of quantitative genetics. Based on statistical methods, the weights of the total phenotype variation that belong to its different fractions (causal components) are quantified: variation due to gene additive effect, variation due to allelic and non-allelic interactions, variation due to environment (general and special), variation due to genotype-environment interaction and possibly variation due to the association between genotype and environment. In this study, during 2017-2020, we used the method of analysis of variance with two sources of variation. The material was represented by 538 individuals from Hucul horse breed analyzed at 18, 30 and 42 months old). The heritability of character was 0.3402±0.1546 (18 months), 0.5549±0.2225 (30 months), 0.4506±0.1895 (42 months), suggest that this is a hereditary condition that follows a quantitative model of inheritance, where the influence of additive genetic factors is moderate to intense. We can conclude that, in this native breed and for this character, a significant share of the phenotypic value is due to the additive effect of genes.

Key words: Genetics, Genotype, Growth, Height, Heritability, Horse, Phenotype, Variance.

The importance of knowing the particularities of the growth process in horses lies in identifying the way in which its influencing factors act and thus the best conditions can be ensured to achieve a proper process and remove the unfavorable conditions (Marginean *et al*., 2005, 2012). Also, by knowing the particularities of the growth process, it can be achieved the directed growth of organisms, respectively we can determinate those changes in growth that are useful.

The obtained results can contribute to the improvement of the breeding process, in horses, in order to obtain some breeders of high genetic value, with maximum genetic and economic efficiency, which would be an enormous satisfaction (Maftei *et al*., 2004).

Genetic parameters are nothing but functions of these population components of variance-covariance. Thus, the major role of quantitative genetics in animal husbandry is to highlight and quantify the elements that contribute to the formation of the phenotype of economically useful characters, mostly quantitative (Popa, 2009).

In order to achieve the proposed objectives, the biological material used in this experiment comes from Lucina Studfarm, Suceava County, Romania and is represented by a sample of 538 individuals (males and females), belonging to 20 stallion families (half-brothers/half-sisters), from 5 genealogical lines, all individuals belonging to Hucul horse breed, a romanian native breed. The research and analysis were performed in the profile laboratories of the University of Agronomic Sciences and Veterinary Medicine, Animal Sciences Faculties from Bucharest and Timisoara.

The distribution of the subjects is presented in Table 1.

The sample extracted from the population under analysis was studied during three ages, respectively at three different classifications (ranking): 18 months, 30 months and 42 months old. The sample was extracted in such a way that the analyzed individuals had a performance recorded in each of the three classifications (at each age studied), as it was desired to achieve a balanced experimental plan.

The character that was followed to assess the evolution of the growth process of individuals was the wither's height, in this case, due to great importance, of this character, in horse's selection and evaluation process (Maftei *et al*., 2008, 2009).

In the present study it was used the variance analysis method with two sources of variation. Based on these values, the causal components of the variance were then determined as follows: phenotypic variance, additive variance, variance due to genetic dominance, variance due to the environment. Heritability was estimated by the ratio of additive variance to total phenotypic variance. Heritability's error estimation was performed using the simplified method of A. Robertson (Falconer and Mackay, 1997; Saastamoinen 1990).

[1]University of Agronomic Sciences and Veterinary Medicine, Bucharest, Romania, 59 Marasti Avenue, District 1, Bucharest, Romania.
[2]Univeristy of Agricultural Sciences and Veterinary Medicine, Timisoara, Romania, 119 Aradului Avenue, Timisoara, Timis County, Romania.

Corresponding Author: Daniela Ianitchi, University of Agronomic Sciences and Veterinary Medicine, Bucharest, Romania, 59 Marasti Avenue, District 1, Bucharest, Romania.
Email: agrozoovet@gmail.com

How to cite this article: Maftei, M., Ianitchi, D., Pruna, M. and Dronca, D. (2022). Partial Results Regarding the Genetic Determinism of Growth Process in a Native Horse Breed using Wither's Height. Indian Journal of Animal Research. DOI: 10.18805/IJAR.BF-1435.

Submitted: 06-09-2021 **Accepted:** 25-09-2021 **Online:** 01-01-2022

Table 1: Distribution of biological material.

Stallion's bloodline	Family size	Males /family	Females /family
Goral	**87**	**35**	**52**
- Goral XV	10	5	5
- Goral XVI	50	17	33
- Goral XVII	1	0	1
- Goral XVIII	12	5	7
- Goral XIX	14	8	6
Hroby	**177**	**84**	**93**
- Hroby XVI	10	3	7
- Hroby XVII	13	6	7
- Hroby XVIII	3	1	2
- Hroby XIX	31	15	16
- Hroby XX	54	29	25
- Hroby XXI	66	30	36
Ouşor	**90**	**35**	**55**
- Ouşor VII	29	9	20
- Ouşor VIII	39	15	24
- Ouşor IX	22	11	11
Pietrosu	**91**	**44**	**47**
- Pietrosu VIII	6	2	4
- Pietrosu IX	65	31	34
- Pietrosu X	20	11	9
Prislop	**93**	**44**	**49**
- Prislop VIII	26	14	12
- Prislop IX	62	27	35
- Prislop X	5	3	2
Total	**538**	**242**	**296**

The sample extracted from the population was studied during three ages, respectively at three different classifications (rankings): Rank I - at the age of 1.5 years; Rank II - at the age of 2.5 years; Rank III - at the age of 3.5 years.

The sample was extracted in such a way that the analyzed individuals had a performance recorded in each of the three classifications (at each age studied), as it was desired to achieve a balanced experimental plan.

The study of the genetic determinism of the growth process was performed based on the estimation of the causal components and the heritability of wither's height character.

The results obtained in the analysis of the causal components of the variance, for the wither'a height character, during the three ages, lead to the following additions:

- The "wither's height" character is a character with a medium to intense genetic determinism during the three ages, the additive variant having a weight between 34.026% and 55.49%.
- Variance due to dominance has a share between 3.23% and 4.42% of the total phenotypic variance.
- The variance due to the environment has a weight with a decreasing tendency during the three ages, the highest value being at the age of 1.5 years (61.56%).

The calculated value of the Fisher test (F = 1.44) shows that, at the age of 18 months, there were no significant differences between the individuals of the five bloodlines. Fisher test values, calculated for the other two ages (30 and 42 months old) show significant differences (F = 7.36, respectively F = 7.07).

The detailed analysis of this situation, performed with the help of the Tukey test, highlights the fact that these differences are generated by individuals belonging to the Ousor bloodline. There are no significant differences between the performances of the samples from the other bloodlines. This situation can be explained by the existence of genetic differences between Ousor bloodline and the other genealogical lines. As a result, it becomes imperative to intensify the selection work to improve the wither's height character at this bloodline. The absence of significant differences between the other bloodlines is a consequence of a high genetic similarity, as a result of the use of the mating system based on interfamilial rotary crossing.

The values of the heritability coefficient, for the wither's height character, fall within the limits cited by the literature, there is a high degree of variability from this point of view between horse populations, generated by their different genetic structures (Saastamoinen, 1990, Sadek *et al*., 2006).

CONCLUSION

The results obtained in the analysis of the causal components of the variance for the wither's height character, during the three ages, lead to the following additions:

- The "wither's height" character is a character with a medium to intense genetic determinism during the three ages, the additive variance having a share between 34.026% and 55.49%.
- The variance due to dominance has a share between 3.23 and 4.42% of the total phenotypic variance.
- The variance due to the environment has a weight with a decreasing tendency during the three ages, the highest value being at the age of 1.5 years (61.56%).

From the analysis of the presented results it is observed that, in the analyzed population, the wither's height is a character that presents a medium to intense genetic determinism, during the three ages. Analyzing the obtained values, a variation of the heritability coefficient can be observed at the three determinations.

Knowing that heritability expresses the proportion of the total variance that can be attributed to the average effect of genes, it follows that, in the case of wither's height, a significant share of the phenotypic value is due to the additive effect of genes.

It is very clear that in the post uterine period, the parameters of the growth process for the wither's height vary in close dependence with age. Their highest values are found in the first part of life, they show a decreasing trend in relation to the age factor. As a result, any deficiencies in the technology of breeding young horses during the period of maximum intensity of this process, has extremely serious

repercussions on the productive life of the animal, as they are irretrievable.

REFERENCES

Falconer D.S., Mackay, T.F.C. (1997). Introduction to Quantitative Genetics, Fourth Edition. Longman Group Ltd., ISBN 9780582243026.

Maftei, M., Popa, D., Nicolae, C., Popa, R., Pogurschi, E. (2009). Study about wither's height average performances in hucul horse breed-Pietrosu bloodline, Oradea University Annals, vol VIII, p. 559-562, ISSN 2065-3484.

Maftei, M., Popa, D., Nicolae, C., Popa, R., Pogurschi, E. (2009). Study about withers height average performances in hucul horse breed- Ouşor bloodline, Oradea University Annals, vol VIII, p. 563-567, ISSN 2065-3484.

Maftei, M., Popa, D., Popa, R. (2009). Study about withers height average performances in hucul horse breed, Prislop bloodline, Scientific Papers Faculty of Animal Sciences Bucharest, vol. 52, Total Publishing, p. 288-291, ISSN 12244295.

Maftei, M., Popa, D., Popa, R. (2009). Withers height comparative analysis in five Romanian Hucul horse bloodlines, Scientific papers Faculty of Animal Sciences Bucharest, vol 52, Total Publishing, p. 80-82, ISSN 12244295.

Maftei, M., Popa, D., Popa, R. (2008). Study of withers height average performances in Hucul horse breed-Hroby Bloodline. Scientific Papers, Faculty of Animal Sciences and Biotechnologies. 41(2): Agroprint Publishing House, Timisoara, p. 573-576, ISSN 1221-5287.

Maftei, M., Popa, D., Popa, R., Lucica N. (2008). Study of withers height average performances in Hucul horse breed-Goral Bloodline. Scientifical Papers, Faculty of Animal Sciences and Biotechnologies. Agroprint Publishing House, Timisoara. 41(2): p. 568-571, ISSN 1221-5287.

Maftei M., Sandulescu D., Popa R. (2004). Note about Increasing the Economical Efficiency of the Romanian Hucul Breed, Book of abstracts of the 55th Annual Meeting of E.A.A.P, ISSN 1382-6077.

Marginean, Gh. E. *et al*. (2012). Hippology Treatise, Publishing House of Romanian Academy, pp. 228-232, ISBN 978-973-27-2177-3.

Marginean, Gh., Georgescu, Gh., Maftei, M. (2005). Practical Workbook for Horse Exploitation, AgroTehnica Publishing House, Bucharest, ISBN 973-87716-0-9.

Popa, R. (2009). Breeding programms, Printech Publishing House, pp. 120-172, ISBN 978-606-521-293-0.

Saastamoinen, M. (1990a). Heritabilities for body size and growth rate and phenotypic correlations amond measurements in young horses. Acta Agriculturae Scandinavica. 40: 377-386. DOI: 10.1080/00015129009438573.

Saastamoinen, M. (1990b). Factors affecting growth and development of foals and young horses. Acta Agriculturae Scandinavica. 40: 387-396. DOI: 10.1080/00015129009438574.

Sadek, M.H. *et al.* (2006). Factor analysis of body measurements in Arabian Horses. Journal of Animal Breeding and Genetics. 123(6). DOI: 10.1111/j1439-0388.2006.00618.