BREEDING VALUES OF LIPIZZANER STALLIONS FOR SOME BODY MEASUREMENTS

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Summary

Breeding and selection of the Lipizzaner horses are based on estimating of the body conformations, which should correspond to the desirable type of the breed in question. Some information about the stallion s offspring can reduce the testing time and speed up the decision-making concerning the selection. The purpose of this study was to estimate the breeding values of the Lipizzaner stallions for height at whiters and chest girth under the breeding conditions in the Centre for horse breeding and selection in Đakovo, Croatia. The data were obtained on 305 foals sired by 12 stallions. The genetic and the phenotypic variances were estimated by means of the restricted maximum likelihood (REML procedure). The heritability for height at whiters and chest girth was 0.26 and 0.25 respectively. The breeding values for body measurements were estimated by BLUP method. The model included the year of birth, the foaling number and the sex as fixed effects, and sires as random effects. The estimates concerning breeding values ranged from 0,611 to -0.264 form height at whiters and from 0.215 to -0.232 for the chest girth. This paper also discusses the rank of stallions concerning the estimation of the breeding values and possibility to use such issues of information in breeding and selection.

Introduction

The Stud Farm Đakovo, which is a part of the Centre for Horse Selection of Republic Croatia, is a nursery of high quality Lipizzaner horses and is considered to be among the greatest in Europe.

The breeding aim is to increase the early maturity and the body frame, but to keep the attractive race characteristics - as temperament, gait, obedience, toughness and harmonious movements.

To attain the wanted frame and well-built bones of Lipizzaner horses, during the past ten years or even more, according to the breeding plan, beside those from their own breeding, also were used stallions from other breedings (Hungary, Romania).

The earliest informations on body measures are obtained by regular measurement of foals of certain age groups, what enable us to find out the upgrowth and development

rate, having insight into the body frame. This information offers the possibility for an early evaluation of stallions breeding values concerning the mentioned characteristics. This is the aim of these researches.

Material and Method

The data consisted of body measurement record for Lipizzaner foals sired by 12 stallions. Foals were measured 7 days after foaling and appoximately at age of 6 month. The total number of foals was 305. The data were edited to include only sires having at least 10 offspring.

Height at withers, hearth girth and cannon bone circumference were measured.

Table 1. - STRUCTURE OF DATA

Stallions	Blood Line	Number of Foals (Males and Females)
29	Conversano	28
39	Tulipan	36
90	Pluto	19
115	Conversano	33
125	Siglavy	24
179	Favory	14
215	Neapolitano	17
305	Conversano	15
312	Conversano	34
1437	Maestoso	13
1680	Maestoso	15
5314	Favory	56
Total: 12	7	305

A single BLUP (Best Linear Unbiased Prediction) model was used for prediction the breeding values of stallions for two body measurements.

In generally the model for analysis was

$$Y = X\beta + Za + e$$

where
Y = vector of observation on the i-th animal
β = vector of unknown fixed effects
a = vector of unknown random additive genetic effects
X = matrix of fixed effects
Z = matrix of additive genetic effects
e = vector of the random residual effects

Model in matrix notation was

$$\begin{bmatrix} X'X & X'Z \\ sym & Z'Z + \alpha A^{-1} \end{bmatrix} \begin{bmatrix} \beta \\ \hat{a} \end{bmatrix} \begin{bmatrix} X'Y \\ Z'Y \end{bmatrix}$$

where
$\alpha = \sigma 2e/\sigma 2a$ and
A = numerator relationship matrix (calculated as described by Henderson (1975) and Quaas (1976).

Breeding value was estimated by

$$BV = 2 \times \hat{a}$$

The model included sex, foaling oder and year of foaling as systematic fixed effects. Sires variances and error variances were estimated by REML procedures, which were used for estimating heritability for body measurement of foals.

Results

Table 1. shows means with standard deviations for the traits studied.

Table 2. - MEANS (X̄) AND STANDARD DEVIATIONS (S) FOR SOME BODY MEASUREMENTS OF LIPIZZANER FOALS

Trait (cm)	Male		Female		Average	
	x̄	s	x̄	s	x̄	s
7 days after foaling						
Height at withers	101.2	5.8	101.7	5.4	101.2	5.8
Hearth girth	81.7	4.9	80.9	5.1	81.5	4.9
Cannon bone circumference	11.6	2.3	11.7	2.1	11.7	2.2
6 month of age						
Height at withers	136.8	5.8	135.7	5.6	136.3	5.6
Hearth girth	136.2	7.3	135.0	7.0	136.1	7.3
Cannon bone circumference	16.2	2.0	16.0	1.6	16.1	2.1

The means of body measurements observed here is in accordance with the results of Rastija et al. (1986) except for the standard deviations which are greater in our investigations.

Table 3 represents the coeefficients of heritability for the body measures at the age of approximately 6 month. Both for the height at withers and chest girth the values of heritability are lower compared to those obtained by Rastija et al. (1991) and Saastamoinen (1990) for the same age, and are in accordance with the values reported by Butler (1986). The heritability for the cannon bone circumference is considerable lower than the values repported by the mentioned authors.

Table 3. - HERITABILITY ESTIMATES FOR HEIGHT AT WITHERS AND HEARTH OF FOALS AT 6 MONTH OF AGE

Trait	h^2	SE h^2
Height at withers	0.26	0.07
Hearth girth	0.25	0.10

Table 4. - ESTIMATES OF BREEDING VALUES FOR HEIGHT AT WITHERS AND CHEST GIRTH OF LIPIZZANER STALLIONS

Stallions	Height at withers		Chest girth	
	BV	Rank	BV	Rank
29	0.614	1	0.0899	4
39	0.4345	2	0.1485	2
90	-0.0633	8	-0.0189	8
115	-0.2247	10	0.0028	7
125	-0.2421	11	-0.1034	9
179	-0.1117	9	0.0456	5
215	0.0873	4	-0.1761	10
305	0.2345	3	0.1764	3
312	-0.0148	7	-0.1761	11
1437	-0.2456	12	-0.2320	12
1680	0.0433	5	0.0438	6
5314	0.0028	6	0.2147	1

In Table 4 is visible that the height at withers is most highest ranked by the stallion "29" Conversano blood line, followed by "39" Tupipan line and on the tird place is again the Conversano line and the stallion "305". The stallion "1437", as the member of the Maestoso blood line, was ranked with the lowest grade.

Although the chest girth is considered as a body measure, which develops slower than the height of animal, the obtained values of young foals still point to superiority of same stallions. The stallion "5314" (Conversano line) has the preference to other stallions and lines. The second place, according to the rank, and the height at withers belongs to the stallion "39" - Tulipan line. The stallion "1437" is on the last place, according to the breeding value for the chest girth too.

Conclusion

The paper reports the average values and variability, as well as the estimates of heritability of foals body measures. BLUP model under respect of relationship matrix on one side, and systematic factors on the other side (influence of sex, year of foaling and order of foaling), offers an objective evaluation of stallion's breeding values concerning the body measures, based on early data of their offsprings.

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UZGOJNE VRIJEDNOSTI LIPICANSKIH PASTUHA ZA NEKE TJELESNE MJERE

Sažetak

U uzgoju i selekciji lipicanske pasmine konja se u ocjeni genetske vrijednosti pastuha također poklanja pažnja tjelesnom okviru, koji treba odgovoriti poželjnom tipu za dotičnu pasminu. Budući da je vrijeme testiranja pastuha relativno dugo, uključivanje informacije o potomstvu može doprinijeti skraćenju trajanja ispitivanja i bržem donošenju selekcijskih odluka. Cilj ispitivanja je bio procjena uzgojne vrijednosti lipicanskih pastuha za visinu grebena i obujam prsa u uvjetima uzgoja u Centru za uzgoj i selekciju konja u Đakovu, u Hrvatskoj. Podaci se odnose na 305 ždrebadi, potomaka 12 pastuha. Genetske i fonotipske varijance ocijenjene su REML procedurom. Heritabilitet za visinu grebena i opseg prsa iznosio je 0,26 odnosno 0,26. Uzgojne vrijednosti za ove tjelesne mjere ocijenjene su BLUP metodom i to s modelom koji je uključivao godinu rođenja, redosljed ždrebljenja i spol ždrebadi kao fiksne, a očeve kao slučajne efekte. Ocjene uzgojnih vrijednosti varilale su od 0,614 do -0,246 za visinu grebena i od 0,215 do -0,232 za obujam prsa. U radu je također diskutirano o redosljedu pastuha glede ocjena uzgojnih vrijednosti i mogućnostima korištenja ovakvih informacija u uzgojno-selekcijskom radu.