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HERITABILITY AND PHENOTYPIC CORRELATION AMONG BODY MEASUREMENTS OF LIPIZZANER HORSES

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Summary

The researches of heritability and correlation among the withers height, chest volume, and cannons volume have been done on 368 horses of the Lipizzaner breed in different phases in the Horse Selection Centre in Đakovo (Croatia). The data processing have been done by the method of the least squares.
The largest value of heritability (h^2) for the withers height has been established in the age of 6 months (0.80) and the smallest in the age of 12 months (0.49). The heritability values for the chest volume range between 0.31 and 0.68, and for the cannons volume between 0.25 and 0.58. The phenotypic correlations between properties were positive, except for the chest volume in the age of 6 months and cannons volume at birth being slightly negative (r = -0.096). The correlations between properties are more expressed with horses of the same age then for the different one.

Introduction

The heritability of some property as well as the strength of mutual connection among the individual properties of horses represent the significant indicators of success of breeding and selection work in horse-breeding. The aim of this work was to determine heritability and correlations of some body measurements in the individual phases of the Lipizzaner horses growth.

Material and methods

The heritability and phenotypic correlations among body measurements of Lipizzaner horses have been established on 368 heads, the descendants of 22 stallions. The data processed comprised the stallions with 8 or more offsprings. The research have been done in the Horse selection Centre of Croatia in Đakovo. The measurements of the withers height, chest volume, and cannons volume in centimeters have been performed during the birth and then in the age of 6, 12, 24, and 36 months. The phenotypic and genetic parameters of the body measurements of the Lipizzaner horses have been evaluated by the variance analysis according to the method of the least squares (Harvey, 1977). For the variance analysis we have chosen the mixed type of the statistical model. The heritability of the body measurements has been evaluated by the method of paternal half-sib correlation.

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Results and discussion

The heritability estimates for the processed characteristics of the body measurements of Lipizzaner horses are very high. The researches have shown that the heritability for the stated properties is expressed as the strongest for the withers height. The heritability for the chest volume has been ranging between 0.25 and 0.58. The value in the table 1 indicates that the body development depends largely on the hereditary factors while the influence of the paragenetic factors on the body measurements and particularly on the withers height has been less expressed. The heritability value of the young Finnish horses according to Saastamoinen (1990) for the withers height, chest volume, and cannon volume was higher in the older age. According to Butler (1986) the heritability for the withers height was $h^2 = 0.25$, for the chest volume $h^2 = 0.27$, and for the cannons volume $h^2 = 0.47$.

Table 1. - HERITABILITY OF BODY MEASUREMENTS OF LIPIZZANER HORSES AT DIFFERENT AGE

Body measurements		Age in months			
		6	12	24	36
Withers Height	h^2	0.80	0.49	0.75	0.51
	S.E.	0.25	0.19	0.24	0.20
Chest Volume	h^2	0.30	0.52	0.42	0.68
	S.E.	0.16	0.20	0.18	0.23
Cannons volume	h^2	0.58	0.25	0.48	0.47
	S.E.	0.21	0.14	0.19	0.19

Varo (1965) states the heritability to be significantly lower for the cannons volume ($h^2 = 0.13$) than for the withers height ($h^2 = 0.26$) and chest volume ($h^2 = 0.32$). The results in table 1 indicate the existance of the positive correlations between withers height and chest volume of the Lipizzaner horses. The correlation between stated properties is more expressed with the horses of the same age and is ranging between 0.529 and 0.679. The correlation between the withers height and chest volume is less expressed in the different age with the coefficients of the correlation between 0.003 and 0.393.

Table 2. - COEFFICIENTS OF PHENOTYPIC CORRELATIONS BETWEEN WITHERS HEIGHT AND CHEST VOLUME OF LIPIZZANER HORSES AT DIFFERENT AGE

Wither/Chest	Age in months				
Height/Volume	at birth	6	12	24	36
at birth	0.550	0.245	0.188	0.135	0,043
6	0.307	0.635	0.296	0.114	0.003
12	0.330	0.272	0.679	0.265	0.121
24	0.323	0.211	0.377	0.529	0.322
36	0.178	0.230	0.257	0.393	0.542

In table 2 is evident that the higher horses have got larger chest volume which is the significant during the selection of heads for breeding. Rastija et al. (1988) state

the negative correlation with the male heads and slightly positive to slightly negative correlation with the female heads. Saastamoinen (1990) states the correlation coefficients to range between height and chest volume r = 0.28 and 0.55 which corresponds to the value of our research.

The correlations between withers height and cannons volume of the Lipizzaner horses is positive with the correlation coefficients between r = 0.157 and 0.528. The correlation is more expressed in the same age while in the different age it is significantly less expressed (Table 3). The research results indicate that the higher horses have better developed skeleton. In his researches Saastamoinen (1990) states that the correlation between withers height and cannons volume is positive with the correlation coefficients r = 0.44 and 0.57 which corresponds with the value of our research.

Table 3. - CORRELATION COEFFICIENTS BETWEEN WITHERS HEIGHT AND CANNONS VOLUME OF LIPIZZANER HORSES AT DIFFERENT AGE

Withers/Cannons	Age in months				
Height/Volume	at birth	6	12	24	36
at birth	0.325	0.367	0.269	0.212	0.208
6	0.157	0.582	0.423	0.270	0.173
12	0.209	0.287	0.437	0.342	0.262
24	0.210	0.345	0.346	.0.502	0.414
36	0.183	0.295	0.314	0.414	0.512

The correlation coefficients between the chest volume and cannons volume with the Lipizzaner horses are positive with the correlation coefficients ranging between r = 0.047 and 0.631. Between the chest volume in the age of 6 months and the cannons volume at birth the slight negative connection was established with the correlation coefficient of r = 0.096.

Table 4. - CORRELATION COEFFICIENTS BETWEEN CHEST VOLUME AND CANNONS VOLUME OF LIPIZZANER HORSES AT DIFFERENT AGE

Chest/Cannons	Age in months				
Volume/Volume	at birth	6	12	24	36
at birth	0.361	0.101	0.123	0.091	0.066
6	-0.096	0.608	0.420	0.273	0.191
12	0.047	0.269	0.356	0.290	0.241
24	0.070	0.190	0.214	0.398	0.364
36	0.051	0.113	0.148	0.290	0.456

The strongest connection is between the stated properties in the same age of the Lipizzaner horses indicating that the horses of the larger body measurements have larger bones. According to Saastamoinen (1990) the relationship between the chest and the cannons volume was positive with the correlation coefficients between r = 0.29 and 0.49. From the stated results of the authors it is evident that the correlation is stronger at the younger then at the older horse categories.

Conclusion

The research of heritability and phenotypic correlation of withers height, chest volume, and cannons volume on 368 lipizzaner horses in the different age (at birth, 6, 12, 24 and 36 months) in the Horse Selection Centre Đakovo (Rep. of Croatia) refer to the folloving conclusions:

- Heritability values for withers height range between 0.49 and 0.08, for chest volume from 0.31 to 0.68, and for cannons value between 0.25 and 0.58;
- Coefficients of correlations between withers height and chest volume are positive and vary between 0.006 and 0.679;
- Between withers height and canonns volume the positive correlation coefficient has been established being more expressed with the horses of the same age;
- Correlation coefficients between chest volume and cannons volume are ranging between 0.096 and 0.631. The results of these researches represent the useful indicators in the raising and selection work aiming to improve the population of the Lipizzaner horse breed in Croatia.

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HERITABILITÄT UND KORRELATIONSVERBUNDENHEIT DER KÖRPERMASSE BEI LIPIZANERPFERDEN

Zusammenfassung

Die Untersuchungen der Heritabilität und Korelationsverbundenheit der Widerristhöhe, des Brust- und Schienbeinsumfangs wurden an 368 Lipizanerpferden in verschiedenen Entwicklungsphasen im Zentrum für Pferdezucht in Đakovo (Croatien) durchgeführt.

Die Datenvererbeitung wurde mit Hilfe der Methode der kleinsten Quadrate gemacht (Harvey 1977). Der grösste Heritabilitätswert (h^2) der Widerristhöhe war im Alter von 6 Monaten (0,80) und der kleinste im Alter von 12 Monaten (0,49). Der Heritabilitätswert des Brustumfangs war zwischen 0,31, und 0,68, und des Schienbeinsumfangs zwischen 0,25, und 0,58.

Die Fenotypskorelationen waren zwischen den genannten Eigenschafften positiv, ausser bei der Geburt, wo sie ein weing negativ waren (r = 0,096).

Die Korrelationsverbundenheit der geprüften Eigenschaften ist bei den Pferden im gleichen Alter deutlicher als bei den Pferden im verschiedenen Alter.

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