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EVALUATION OF STALLIONS BASED ON LINEAR DESCRIPTION OF THEIR DAUGHTERS

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Abstract

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The purpose of our work was an objective evaluation of mares of the Czech warmblood horse based on the linear description, as well as the evaluation of the benefits of stallion breeding based on the linear description of their daughters and – for specific stallions – the evaluation of certain individual exterior traits which are passed on by stallions to their offspring.
Stallion horses with at least 7 descendants were used for the evaluation and determination of the values, mares which underwent a linear description of traits at the age of 3 years. For this evaluation we used available data from the year 1996 to 2012, a total including 251 stallions and 4709 mares and more than 500 000 records related to the linear description. The data were gathered from the database of the Central Register of Horse Breeding at Slatiňany in the Czech Republic. These data were manually compiled using Excel 2007 and then processed and evaluated according to the objectives of the present study using the linear model GLM as well as the statistical programme Scheffe.
The results of the study showed a convincing statistical influence of the stallions on all the monitored exterior traits analyzed on the mares for the father-factor, and after evaluating all the general exterior traits the statistical difference among the stallions was seen as convincing.
We found out that in most cases the breed had no convincing statistical influence on the analyzed traits of the linear description. On the contrary, in terms of the other effects (father and year of measurement) we found a convincing statistical influence on all traits of the linear description. For some stallions we evaluated particular traits of linear description, which they pass on to their female offspring using charts and graphics. Afterwards we compared reciprocally certain stallions according to the traits of the linear description.

Keywords: horse, linear description, Czech warmblood, body conformation

INTRODUCTION

Linear description is an important means of control which allows to discover conclusively if the exterior properties of the sire are passed on to the offspring building up the required exterior properties so that the offspring accomplishes its breeding purpose. In this evaluation the exterior of the horse, 22 individual traits and body demonstrations are evaluated on a scale of 1 to 9 points. This system was originally developed for Holstein cattle in the USA where it has been used since 1977 and at present various modifications are used in horse breeding (Maršálek and Zedníková, 1996). As opposed to present methods of evaluations of the exterior the linear description proved to be more effective (Norman *et al.*, 1983, Pearson *et al.*, 1987); compared to other farm animals, according to Jakubec *et al.*, (1996), evaluations of the body conformation of horses are very important. According to DIERS (1992) the traits included in the linear description should fulfil the following: they must be heritable, instead of subjective assessment they must be linearly described, on the biological scale they must have a linear course, they must have an economic value and be of elementary importance. Saastamoinen (2000), Holmström *et al.*, (1990) and Langlois, (1979) agree in the hypothesis that the exterior of the horse and its formation have a direct effect not only on the mechanics of movement and performance

of the horse, but according to Anderson et al, (2004), Saastamoinena and Barrey (2000), they also have a direct effect on resistance to exterior effects, particularly to factors of stress. According to Wallin *et al.*, (2003) it has been proved that young horses which in other countries are selected on the basis of their exterior assessed by experienced examiners and which have a better assessment also show a better performance. In raising and breeding it is particularly important to evaluate the body conformation of both stallions and mares in the breed in order to upgrade or, if need be, to correct the individual characteristics of the offspring (Stashak, 1987).

In the Czech Republic linear description of horses began to be used in 1996. Since 1998 linear description has been applied in all horse breeds which have a stud book in the Czech Republic (ROČENKA, 2009). Since 1996 all Czech warm-blood mares included in breeding have been evaluated (ROČENKA, 2009). In linear descriptions of the Czech warm-blood 22 traits are assessed, the same as of pony breeds bred in the Czech Republic (Píšová, 2009); linear description of the Old Kladrub horse includes 36 traits (Jakubec *et al.* 2005, 2007, Andrejsová, 2011). In Holland Van Bergen and Van Arendonk (1993) stated that in linear description of the Shetland pony 28 traits were scored on a 40-point scale. In Italy Samoré *et al.* (1997) mentioned that 26 traits of the conformation of the Haflinger horse were assessed, the same as Koenen *et al.* (1995) for the linear description of KWPN horses in Holland. Luhrs *et al.* (2006) stated that the objective of this method was not only to provide the owner and breeder of the horse with information but at the same time to help the breeding unions calculate the breeding values.

The principle of the system of linear description lies in the combination of a description of the individual body traits and evaluation of the overall conformation characteristics which immediately follows the description proper. Description of the individual traits is based on the model – comparison with the desirable formation. That is why some traits score 5 points and 1 and 9 points are taken as extreme, therefore undesirable. On the other hand, the ideal type and length of stride and trot scored the highest number of points (Vostrý *et al.*, 2008; Vostrý *et al.*, 2009).

The actual expression of traits is recorded and described in such a way that if necessary the animal could be expressed graphically. In the total evaluation the resulting mark for the conformation is specified (Maršálek, 2008).

Linear description is an integral part of evaluations in performance tests and when entering the horse in the stud book. This method is important when compiling the breeding programme and in its effective back-control. Tha is the reason why we selected traits of linear description for the analysis of body conformation and its heredity in the Czech warmblood horse.

MATERIALS AND METHODS

The objective of our research was to evaluate the effect of some effects on traits of linear description in Czech warm-blood mares and to evaluate the breeding contribution of stallions based on the linear description of their daughters.

For the evaluations chosen were stallions with at least 7 daughters of 3 years of age evaluated by linear description. For the evaluations we used available data from 1996 to 2012 incorporating 251 stallions and 4709 mares which had more than 500 000 records related to linear description.

The basic database was provided by the Central Register of Horse Breeding in Slatiňany. The data from the Central Register of Horse Breeding were processed manually in the Excel 2007 programme and then processed and evaluated according to the objectives of the present paper, i.e. manual copies of valuation sheets of the individual mares from the period between 1996 and 2012.

Each mare in the database was given the following data: name, date of birth, identification number, breed, descent (father, mother, father of mother), year of measurements and complete score of linear description and evaluation using the 10-point scale.

All the 22 monitored traits of linear description of the mares were statistically evaluated using GLM (general linear model). As effects affecting the traits of the body conformation we chose the effect of the breed, father and year of entering in the stud book (year of measurement).

The model equation for the calculation is as follows:

$$y_{ijkl} = \mu + a_i + b_j + c_k + e_{ijkl}$$

where:
y_{ijkl} – evaluated quantity
μ – total mean of the group
a_i – fixed effect breed (i = 1…7)
b_j – fixed effect father (j = 1,…251)
c_k – fixed effect year of measurement (k = 1,…16)
e_{ijkl} – random effect

We tried to find out if the selected effects have a statistically significant effect on each of the variables. If the effect was statistically significant we continued in our calculations using the method of multiple comparisons according to Scheffe. Stallions to be evaluated were selected according to how they were used in breeding.

I: *Assessment of the effect of the monitored effects on evaluation of the exterior*

Source of variability	Breed	Father	Year of measurement
Type	**	**	**
Frame		**	**
Nobleness		**	**
Length of neck		**	**
Deployment neck		**	**
Length of withers	*	**	**
Length of back		**	**
Shape of back		**	
Length of loins		**	**
Shape of loins		**	**
Length of croup		**	**
Posture of croup		**	**
Shoulder blade		**	**
Fore pastern		**	*
Fore hoof		**	
Posture of hind legs		**	**
Hind pastern		**	*
Hind hoof		**	**
Width of body		**	**
Shape of croup		**	**
Length of stride	*	**	**
Length of trot		**	**

RESULTS AND DISCUSSION

Zh Evaluation of the effect of some effects on traits of linear description of Czech warm-blood mares

We discovered:

- a highly statistically significant effect of the father factor on all the traits,
- a highly statistically significant effect on most of the traits of the year of measurement,
- a highly statistically significant or statistically significant effect of the breed on the type, length of withers and length of stride.

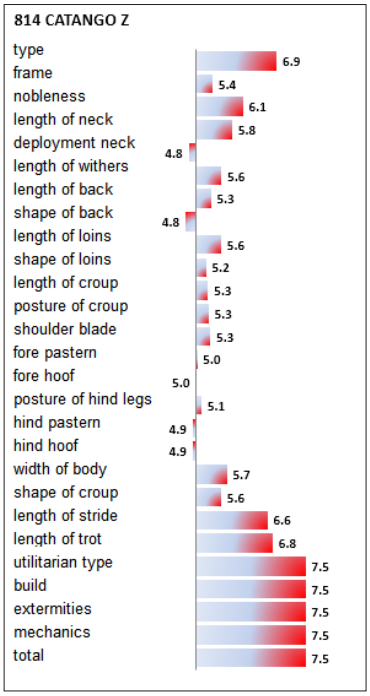
As the results showed, the effect of the father was statistically significant on all counts. By contrast in most cases the effect of the breed was not statistically significant, but statistical significance was proved in the case of the commercial type variable. Since the breeds were different it is logical that the type of each of them was different too. In terms of the factor of the year of measurement a statistically significant effect was proved on all traits of linear description and evaluation on the 10-point scale, with the exception of the shape of the back and the fore hoof. Results of multiple comparisons of the trait type showed the highest results in 2012, 2007, 2009, 2011 and 2008.

Evaluation of the breeding contribution of stallions based on linear description of the daughters

As one of the selected stallions we picked out 814 Catango Z which in our research had the highest number of evaluated daughters. By 2012, in the central register of horses 814 Catango had entered 97 mares with linear description at 3 years of age.

Fig. 1 gives the result of linear description and shows that his daughters had a typical, mid-sized frame, they were nobler, tended to a longer neck, but set lower. The withers were rather long and of medium length, firm back, sometimes somewhat looser. The loins were of medium length to long, firm and well bound, the medium long croup was slightly slanted, adequately wide, well formed, rather rounded. The shoulder blade was adequately long and slanted, the fore pastern and fore hoof regular, well angled and well-formed. The hock of the hind legs was well-angled, the hind pastern adequately long, well-angled, the hind hoof regular and well-formed. The body is usually wide. The length of stride and the length of trot were longer. Mechanics of movement in stride scored 6.8 points, i.e. 0.2 points more than length in trot – 6.6 points.

Tab. II show the statistically significant differences in the multiple comparisons of the linear description for the father factor.



1: *Linear ratings daughters stallion 814 Catango Z*

II: *Number of daughters and mean of stallions for score in total*

Name of stallion	Number of daughters	Mean of compared stallions
Catango	97	7.5340
Amon – 2	7	6.5714
Libero	10	6.6800
Czagoš	23	6.7304
Shagya unčš	10	6.7500
Darex s.v	13	6.7923
Dux lips	8	6.8125
Admetos	12	6.8333
Century	12	6.8667
Harun	11	6.8727
Duramus	10	6.9100
Lokaj	10	6.9100
Hurikán	12	6.9333
Taarlon	13	6.9462
Boleslaw	21	6.9476
Amon lit.	11	6.9727
Grewot s.v.	25	6.9800
Fou D' Am.	17	7.0118
Div týnský	17	7,0118
Mykonos-21	23	7.0125
Cent Honor	14	7.0143
Landruf	22	7.0448

Name of stallion	Number of daughters	Mean of compared stallions
Fallada žih.	18	7.0500
North Star VIII-30	25	7.0563
Genius-14	31	7.0596
Hugben	23	7.0652
Diktant slat.	37	7.1000
Libero – 6	25	7.1115
Adriano – 1	23	7.1194
Burbon	32	7.1222
Litograf – 20	14	7.1231
Libertus	24	7.1333
Topas – 8	34	7.1556
Almhirt chlum.	27	7.1589
Renomee	59	7.1797
Mineral	61	7.1852
Frühesch	26	7.2200
Quoniam pecín	33	7.2297
Przedswit XIV-64	34	7.2410
Furioso I – 21 Honor	20	7.2652
Dietward – 23	38	7.2680

CONCLUSION

As recommendation for future breeding activities we lean towards a stricter selection of stallions and mares, to reduce the number of stallions excluding those which have less than 10 registered mares after a certain period of time and to give preference to quality over quantity. To concentrate more on the assessors and their theoretical and practical training, because the assessment of horses is subjective and the assessor may damage the horse by an erroneous evaluation and hence disturb the entire system. We see that there are great reserves in the scoring system.

In the present study we wanted to prove that stallions have a statistically significant effect in the transfer of the respective traits. In this area we have succeeded. When mating mares and selecting the stallions some horse breeders do not realise that the fundamental body conformation traits are inherited over several generations and that in breeding activities it is of utmost importance to monitor not only the conformation and performance of the animal – but to homogeneity of the lines in a wider outlook. We were successful in proving the significant effect of the father on all the traits. At the same time we assume (and the results of out comparisons confirm) that a correct exterior is a basis for long-term and high performance of the horse.

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