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## INFLUENCE OF LINES OF SIRES AND BREEDS OF SIRES ON DIFFERENCES IN THE BODY MEASUREMENTS OF THE CZECH WARBLOOD COLTS IN REARING FACILITIES FOR TESTING YOUNG HORSES (RFT)

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### ABSTRACT

The objective of the study was to evaluate the effect of the breed of sire and line of sire on grading of the body measurements of the young horses. The groundwork database contained data from 2001 to 2011 from nine RFT's. The database was processed statistically using the GLM method to assess the statistical significance of the effect of the breed of the sire and line of the sire on differences in the body measurements: stick-measure, heart-girth and bone. By multiple comparisons of the individual effects using the Tukey-B method we discovered statistically significant differences in the stick-measure, heart-girth and bone of colts of sires among the respective breeds and lines.

The stick measure of the offspring of Furioso sires is statistically significantly smaller than of the offspring of sires of the Hanoverian horse, Czech warmblood, Holsteiner horse, Bavarian warmblood and Zangersheide. The bone of the offspring of Furioso sires is statistically significantly smaller than of the offspring of sires of the Czech warmblood. The heart-girth of the offspring of Fra Diavolo xx line is statistically significantly smaller than of the offspring of sires of the following lines: 4800 Ladykiller xx, 4600 Rittersporn xx – Ramzes 4028, 70 Barcaldine, 1100 Przedswit VI-Rad., 92 Phalaris – Nearco. The bone of the offspring of Fra Diavolo xx line is statistically significantly smaller than of the offspring of sires of the following lines: 67 Dark Ronald, 4300 Goldschaum xx, 4600 Rittersporn xx – Ramzes 4028, 1100 Przedswit VI-Rad., 3220 Duellant 3586.

**Key words:** Czech warmblood, testing of colts, body measurements, growth dynamics

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## INTRODUCTION

The most common breed in the Czech Republic is the Czech warm-blood comprising 28% of the total number of horses bred in the Czech Republic (Misař, 2011). The present trend of using the Czech warm-blood horses in riding sports increases the demands for the quality of the horses. The breeding value of an individual and the time-dependent genetic level of the population represent the genetic progress of the population (Příbyl, 2008). The breeding value (BV) is a relative figure which relates to the population in which it was estimated. The assessment of the BV is based on performance tests (Jiskrová, 2009). The mainstay of genetic progress in the performance of the Czech warm-blood is genetic information and phenotype manifestations of performance of the progeny of foals by sires used in the breeding of the Czech warm-blood (Zuravcová, 2009).

Act No. 154/2000 Coll. On selection, breeding and data recording of farm animals (Animal Breeding Act) as amended, based on Act No. 130/2006 Coll. is the legal basis for horse breeding in the Czech Republic. Selection is carried out on the basis of information and results of evaluations (Šarovská, 2010). Young horses and stallions are selected: at registration of foals, at selection of the rearing facility for testing young horses (RFT), during valuation in the RFT's, during basic performance tests, during the 100-day test, on granting selection for breeding and on the basis of information about the progeny. The RFT's serve several purposes. One of the most important is to provide complete data on the tested young horses and on the basis of the results of evaluations of the young horses to carry out performance tests of the parents. Another purpose is the selection of talented individuals predisposed to be used in riding sports (Nováková, 2010).

For selection to be correct it is important, among others, to be familiar with the heritability coefficient and qualities (conformation, jumping qualities) which determine the quality of the animal (Zuravcová, 2009). Dušek (2007) stated that for the stick-measure and tape-measure we can reckon with values of heritability  $h^2$  in a range of 0.60 to 0.70; heart-girth ranges in values of  $h^2 = 0.20$  to 0.30; the heritability coefficient of the bone ranges around 0.35. Body measurements: stick-measure (stallions 162 to 170 cm, mares 161 to 167cm) and bone (stallions 21 to 22.5 cm, mares 19.5 to 22 cm) are part of the breeding objective of the Czech warm-blood horse (Nováková, 2010).

The objective of the study was to evaluate the effect of the breed of sire and line of sire on grading of the body measurements of the young horses. The statistical method was used to evaluate whether the breed of sire and line of sire affected the growth of body measurements of the young horses.

## MATERIAL AND METHODS

The groundwork database was created on the basis of results of tests of the young horses in the RFT in co-operation with the Central Records of Horses in Slatiňany. The database includes data from the following RFTs: Albertovec, Horní Město, Chlumeč, Luka-Týn, Tlumačov, Měnik, Nový Dvůr, Suchá, Železnice.

Groundwork data included results of regular spring and autumn grading of young horses in the RFTs in the period from 2001 to 2011. Incomplete data of young horses (due to death of the young horses during the testing or excluding the young horses from testing by decision of the assessing committee) were eliminated. The database of each young horse consists of the name of the young horse, date of birth, identification number, life number, name of sire, name of dam, name of sire of dam, owner of the young horse, the rearing facility for testing young horses and body measurements (stick-measure, tape-measure, heart-girth, bone) and grades for the body conformation, mechanics of movement and growth standard. The body conformation and mechanics of movement were graded on a scale of 1 to 5, the growth standard on a scale of -2 to

+2. Body measurements are given in centimetres. The measurements of the young horses were carried out at the age of 6, 12, 18, 24, 30 and 36 months and are distinguished by indices 1 to 6.

Analysis of variance was performed using the GLM method and followed by tests for factors: breed of sire and line of sire, rearing facility and year of grading the young horses in the RFT according to the model equation:  $y_{ijkl} = \mu + p_i + s_j + y_k + e_{ijkl}$ , where:  $\mu$  = general mean value,  $p_i$  = effect of the  $i^{\text{th}}$  breed of sire/line of sire ( $i = 1, \dots, 7$ ),  $s_j$  = effect of the  $j^{\text{th}}$  rearing facility ( $j = 1, \dots, 11$ ),  $y_k$  = effect of the  $k^{\text{th}}$  year of test ( $k = 1, \dots, 37$ ),  $e_{ijkl}$  = residue.

Where the results were statistically significant we conducted multiple comparisons of the individual effects using the Tukey-B method and the focus was on comparisons of the breed of sire and line of sire. For processing the database and statistical evaluation we used the Excel and Unistat, version 5.1 programmes.

## RESULTS AND DISCUSSION

The groundwork database contained data from the year 2001 to 2011 from nine rearing facilities for testing young horses: RFT Albertovec, RFT Chlumeck, RFT Horní Město, RFT Luka-Týn, RFT Měnik, RFT Nový Dvůr, RFT Suchá, RFT Tlumačov, RFT Železnice. Selected for the database were only young horses with complete data. The groundwork database contained data from the respective grading of 720 colts by 145 various sires. The colts were divided into groups according to the breed and line of the sire. The groundwork database was used as a base to evaluate breeds and lines which had 5 or more colts in the groundwork database and whose data were complete. The Stud Book Code of the Czech warmblood allows the use of the Thoroughbred and a relatively wide range of breeds bred for sports performance to improve the properties and to boost performance (Misař, 2011). In 2001 to 2010 sires of 12 breeds were used in the breeding of the Czech warmblood; they belonged to 30 lines of warmblood horses. Sires of one line are frequently entered in various stud books. That is why we evaluated separately the effect of the breed of the sire and effect of the line of the sire on the body measurements of the colts in the rearing facilities for testing young horses.

In the period of 2001–2010 the most frequently used sires were the following breeds: Czech warmblood (40 sires), Holsteiner horse (33 sires) and the Hanoverian horse (24 sires); they comprised 2/3 of the sires used in breeding. Other breeds were represented by 5 sires, on average. Most of the tested progeny were by sires of the Holsteiner horse (226 colts), Hanoverian horse (165 colts) and the Czech warmblood (127 colts). Sires of the Czech warmblood make up the largest part of sires used in breeding (27 %), to a lesser extent sires of the Holsteiner horse (23 %) and the Hanoverian horse (17 %); only less than 10 % are other breeds. Since the number of sires is high, the number of colts born by the individual sires is low; as a result the numbers of the tested progeny are low (Misař, 2011).

The most numerous progeny in the rearing facilities for testing young horses was by sires of the following Dutch warmblood breed: Amarillo, Silvio II, Guidam Sohn and Oscar, each with more than 7 progeny tested. The Hanoverian horse used in the breeding of the Czech warmblood is most frequently represented by sires Faraday, Federweisser, Dantes, Grand Step, Le Patron and Radegast. Most of the progeny in the testing facilities is by the following sires of the Holsteiner horse: Ballast, Cassilius, Landino, Lantaan and Catango Z. Thoroughbred sires are used in the breeding of the Czech warmblood to a lesser extent; more progeny in the tests were only by the sire Regulus. The sires of the Selle Français represented in the breeding of the Czech warmblood are First Bride, Manillon Rouge and Baxte de Quettehou. The number of progeny by sires of the Czech warmblood in the rearing facilities for testing young horses is low; more progeny is only by sires Lopez – 11, Przedswit XVI – 64 and Sahib Kubišta. Due to a great number of sires used in breeding and low intensity of selection, the Czech warmblood breed is as yet not very balanced in terms of the type, pedigree and performance (Misař, 2011).

Tab. 1 gives results of an analysis using the GLM method exploring the effect of the line of the sire and effect of breed of the sire on the body measurements of colts in the rearing facilities for testing young horses. It was proved that the line of the sire has a statistically significant effect on the heart-girth and bone of colts aged 18 months. It was further proved that the breed of the sire has a statistically significant effect on the stick-measure and bone of colts aged 18 months. By multiple comparisons of the respective effects using the Tukey-B method we explored the statistically significant differences in the body measurements of progeny by sires from the individual lines and breeds. The stick measure of the offspring of Furioso sires is statistically significantly smaller than of the offspring of sires of the Hanoverian horse, Czech warmblood, Holsteiner horse, Bavarian warmblood and Zangersheide. The bone of the offspring of Furioso sires is statistically significantly smaller than of the offspring of sires of the Czech warmblood.

*Tab. 1 Effect of line and breed of sire on evaluations of the body measurements of the progeny in rearing facilities for testing young horses*

Body measurements	Line: statistical significance	Breed: statistical significance
stick-measure (SM)		0.0236
tape-measure (TM)		
heart-girth (HG)	0.0017	
bone (B)	0.0014	0.0055

The offspring by sires of the czech breed was placed seventh in ratings of the stick-measure, averaging 156 cm. The offspring by sires of the Slovakian warmblood was placed first in ratings of the stick-measure, averaging 158 cm. The offspring by sires of the Furioso was the smallest in ratings of the stick-measure, averaging 151 cm. The offspring by sires of the czech breed was placed second in ratings of the bone, averaging 20.7 cm. The offspring by sires of the Bavarian warmblood was placed first in ratings of the bone, averaging 20.8 cm. The offspring by sires of the Furioso was the smallest in ratings of the bone, averaging 19.8 cm.

The heart-girth of the offspring of Fra Diavolo xx line is statistically significantly smaller than of the offspring of sires of the following lines: 4800 Ladykiller xx, 4600 Rittersporn xx – Ramzes 4028, 70 Barcardine, 1100 Przewslaw VI-Rad., 92 Phalaris – Nearco. The bone of the offspring of Fra Diavolo xx line is statistically significantly smaller than of the offspring of sires of the following lines: 67 Dark Ronald, 4300 Goldschaum xx, 4600 Rittersporn xx – Ramzes 4028, 1100 Przewslaw VI-Rad., 3220 Duellant 3586.

## CONCLUSIONS

The The groundwork database contained data collected between 2001 and 2011 from nine rearing facilities for testing young horses: Albertovec, Horní Město, Chlumec, Luka – Týn, Měnik, Nový Dvůr, Suchá, Tlumačov and Železnice. At present the sires most frequently used in breeding the Czech warmblood are sires of the Czech warmblood, Hanoverian and Holsteiner horses. In spite of the diverse structure of the gene pool of dams of the Czech warmblood, the breed of the sire affected the stick-measure and bone of the tested progeny. At one and the same time the line of the sire affects the heart-girth and bone of the progeny. By multiple comparisons of the respective effects using the Tukey-B method we discovered statistically significant differences in the body measurements of the progeny by sires belonging to the respective lines and breeds.

The stick measure of the offspring of Furioso sires is statistically significantly smaller than of the offspring of sires of the Hanoverian horse, Czech warmblood, Holsteiner horse, Bavarian warmblood and Zangersheide. The bone of the offspring of Furioso sires is statistically significantly smaller than of the offspring of sires of the Czech warmblood. The heart-girth of the offspring of Fra Diavolo xx line is statistically significantly smaller than of the offspring of sires of

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