The comparison of selected breedings of Hucul horses bred in the Slovak republic and Hungary

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Abstract: The aim of this work was to compare basic body dimensions and hippo-metrical indices of Hucul horses in the various breedings in Slovak republic and Hungary and found out some differences between these countries in the terms of age, gender, line and environment. First of all in each herd we measured basic body dimensions, then we calculated from measured body dimensions hippo-metrical indices and finally these resultings were analysed statistically and compared with each other. Most of the statistically significant differences were related to the effects of the gender and environment. Out of the 9 body dimensions and indices, 6 were highly signifianted. The line had a statistically highly significant effect on 2 body dimensions and the age was not statistically significant.

Key-Words: Hucul horse, measurement of the horses, basic body dimensions, hippo-metrical indices

Introduction

The Hucul horse is a primitive breed of horses which were very popular with our ancestors for their much appreciated qualities: the horses have a strong constitution; they are surefooted on the rough terrain; easy to feed; of undemanding nature and endurance. These qualities have been successfully preserved to the present day in spite of the fact that for many years the breeders strived to “improve” the Hucul horse by crossing with draught and Fjord horses (efforts to make it stronger) or with Arabian horses (efforts to upgrade the breed). Due to these tendencies at one point in time the Hucul horse came close to extinction. Fortunately due to intensive breeding efforts, in 1979 this small horse was entered in the protected FAO gene pool. Later this breed was ranked among genetic resources not only in Slovakia and in the Czech Republic, but also in Hungary, Poland, Germany, Austria and Ukraine [1]. The gene pool of the Hucul horse is classed among rare resources of genetic diversity. To preserve the high quality of the breeding material permanent monitoring, evaluation and comparisons deem necessary in all countries where this genetic resource exists in order to prevent any greater deviations from the breeding standard.

The Hucul horse is a small mountain breed of well-defined type and typical pace when walking and when overcoming mountain obstacles. Their conformation is correct; the body is long with short and bony legs and tough hoof horn [1]. The head of the Hucul horse is dry and robust, of medium length, wide brain base and strong jowl. The neck is muscular, strong, of medium set, sometimes arched. Not very high-withered, the chest is large, deep and wide. The back is firm, flat, the hips are well bound and short; the croup is short, wide and slightly sloping, the tail is set low. The formation of the front legs is regular, hind legs sometimes bow-legged with converging thighs (allowing better movement in mountain terrains) [2]. Thanks to its body conformation the horse can be used for work in the mountains and also as a draught horse, as a pack horse and for riding [1]. In colour the Hucul horse is usually bay, fawn, black, or chestnut and piebald [3]. Atavistic features appear very frequently: dorsal (eel) stripe (distinct darker stripe on the back), zebra stripes on the knee and forearm and sometimes shoulder stripes (cross). Some individuals show what is called a pale rosette in the area of the dock which is a marking of wild horses. Albinotic markings are undesirable [3].

In the present study we focused on 2 important herds bred in Slovakia, i.e. the National Stud Farm Topoľčianky and Slovakian Hucul Club in Lom nad Rimavicou and 1 big herd in Hungary. In each herd we analysed 5 basic body dimensions, calculated the hippo-metrical indices and statistically processed the results. The objective of our study was to carry out comparisons of selected herds of Hucul horses

in terms of their age, gender, line and environment; to detect potential deviations and to analyse the possible causes.

Material and Methods

The own results of field measuring of the herds of Hucul horses in Slovakia and in Hungary served as groundwork material for our research.

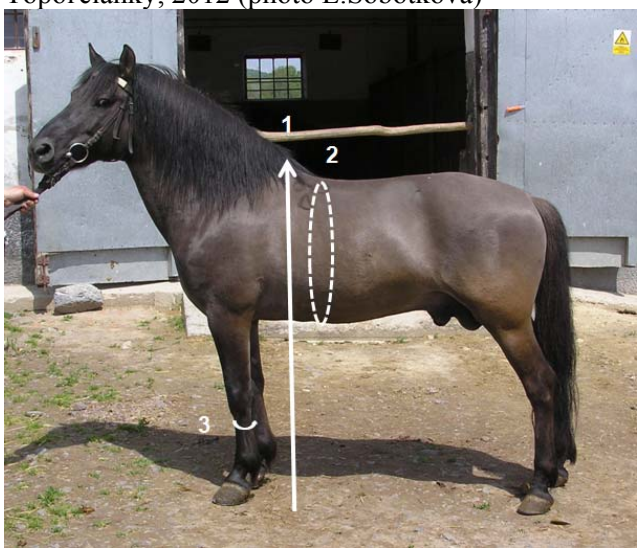
In total we measured 132 Hucul horses. In Hungary we measured 87 horses (65 breeding Hucul mares, 11 breeding Hucul stallions and 11 Hucul geldings) from Aggtelek national park and in Slovakia we measured 45 Hucul horses. In the National Stud Farm Topoľčianky we measured 22 breeding Hucul mares and 5 Hucul stallions. In private sphere horses of the M. Gonda breeder from Slovak Hucul club in Lom nad Rimavicou were measured in the number of 17 Hucul mares and 1 Hucul stallion.

As aids for measurement we used the stick measure (a three-part square folding metal stick with an engraved scale in cm, with two perpendicular arms of which one arm was adjustable) and the tape measure for horses (wax tape with a scale). All the horses were measured in October – December by two assistants using the same aids (therefore eliminating errors in the results). Each dimension was measured three times and in the study we included the resulting average value from these 3 dimensions. During measuring the horses were standing on a flat firm surface and all the 4 limbs were equally weighted. When viewed from the side the chest and pelvis limbs overlapped. In all the measurements we took into account the height of the horseshoe which was then subtracted from the measured values. To obtain correct and as accurate as possible data we used only dimensions which were not in any way disturbed during the measuring process.

Dušek et al. [4] defined the body dimensions as follows:

1. *Stick measure (SM)* – perpendicular distance of the highest point of withers from the ground
2. *Tape measure (TM)* – distance from the outside heel of the left front limb to the highest point of the withers
3. *Heart girth (HG)* – measured behind the shoulder blade and withers at the point of the smallest girth
4. *Circumference of the shank (CS)* – measured at the weakest point of the cannon bone on the left front limb, i.e. at the point where the upper third of the cannon bone passes into the second third

Fig. 1 Basic body dimensions of horses, Topoľčianky, 2012 (photo E.Sobotková)



Legend: 1 – Stick/tape measure, 2 – Heart girth, 3- Circumfence of the shank

The following indices of the body conformation were calculated for all the analysed horses based on field measurements of body dimensions [4]:

1. *Index of the body conformation (IBC)* – (diagonal length of body / stick measure) x 100
2. *Index of robustness (IROB)* – (heart girth / tape measure) x 100
3. *Index of compactness (ICOM)* – (heart girth / diagonal length of body) x 100
4. *Index of boniness (IBON)* – (circumference of the shank / stick measure) x 100

The data were processed using the programme MICROSOFT EXCEL 2000. The database was divided according to:

A) Age
- horses of 3 - 6 years (n = 53)
- horses of 7 - 12 years (n = 49)
- horses of 13 – 18 years (n = 24)
- horses of 19 years and older (n = 6)

B) Gender
- stallions (n = 17)
- mares (n = 104)
- geldings (n = 11)

C) Line
- Goral (n = 36)
- Gurgul (n = 7)
- Hroby (n = 43)
- Oušor (n = 20)
- Prislop and Pietrosu (n = 12)
- Polan (n = 14)

D) Environment
- Slovakia (n = 45)
- Hungary (n = 87)

We used the database to monitor correlations among the body dimensions and indices and age, gender, line and environment. Data on the conformation and indices were statistically processed using the statistical programme UNISTAT version 5.1. :
- by overall numerical characteristics of mean values and rates of variations (the following mean values and rates of variation were evaluated: dispersion and variation coefficient)
- by the GLM (linear model with consistent effects) method.

Model equation of linear model with consistent effects (GLM):

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

Where:
y_{ijklm} = observation of the body rate or index
μ = total mean
a_i = consistent effect of the age of the horse (i = 1,2,3,4)
b_j = consistent effect of the gender of the horse (j = 1, 2, 3)
c_k = consistent effect of the line (k = 1, 2, 3, 4, 5, 6)
d_l = consistent effect of the environment (l = 1, 2)
e_{ijklm} = random residual error

If the impact of the monitored effect was statistically significant we specified the differences among the respective factors of age, gender, line and environment by means of the method of multiple comparisons (Scheffe method).

Result and Discussion
Statistical processing of the data by means of the programme Unistat 5.1 revealed statistically significant and highly significant differences. Table 1 gives a basic outline illustrating the measures and indices of the given effects which came out as statistically significant.

Comparisons of the stick measure
Analysis showed that the effects of the age and environment were not statistically significant on stick measure. Multiple comparisons showed statistically highly significant differences, particularly among the gender and line. Mares (139.02 cm) exhibited the lowest values of the SM and stallions (142.15 cm) and geldings (140.55 cm) the highest. This fact is in agreement with breeding standard of Hucul horses, where Hucul stallions have acceptable higher SM as Hucul mares.

Table 1 Overall results of statistical analysis

Dimens/Effects	Gender	Line	Enviro.
SM	**	**	
TM	**	**	**
HG		*	**
CS	**		**
IBC	**	*	
IROB	**		**
ICOM			**
IBON	**		**

Legend: SM-stick measure, TM-tape measure, HG-heart girth, CS-circumference of the shank, IBC-index of the body conformation, IROB-index of robustness, ICOM-index of compactness, IBON-index of boniness
** indicates a statistically significant effect $p \leq 0.05$*
*** indicates a statistically highly significant effect $p \leq 0.01$*

Jakubec et al. [5] who measured the Old Kladrub horses discovered small differences in the SM between stallions and mares also. Multiple comparisons showed statistically highly significant differences among lines. Lines Pietrosu and Prislop (142.58 cm) exhibited the highest values and line Polan (136.68 cm) the lowest. In her dissertation thesis Matoušová-Malbohanová [6] reached the same conclusions when comparing Hucul horses bred in the Czech Republic and in Poland. Some of the body dimensions of the lines Pietrosu and Prislop showed higher average values than other lines. If we study the average values of body dimensions in greater detail we see that the line Pietrosu has preserved the large body dimensions of its founder. It is of common knowledge that the body dimensions of both the line Prislop and the line Pietrosu are larger than of the other Hucul lines. Krzemień [7] declare that foundation sire of Pietrosu line in Poland, stallion Pietrosu VI-111, exhibited 141 cm SM, 168 cm HG and 19 cm CS. Also the body dimensions of the sire Prislop IX-90 bred in Topoľčianky were above-standard (SM 149 cm, TM 161 cm, HG 190 cm, CS 20,0 cm) Matoušová-Malbohanová et al. [8].

Comparisons of the tape measure
Analysis showed that the effects of the gender, line and environment were statistically significant on tape measure. Multiple comparisons showed statistically highly significant differences among the

gender. Mares (146.57 cm) exhibited the lowest values of the TM and stallions (150.24 cm) and geldings (149.32 cm) the highest. Simčič et al. [9] who measured the primitive breed of Posavje horse in Slovenia and Croatia discovered statistically highly significant differences in the TM between the gender. The TM of stallions was statistically significantly larger by 3.22 cm than the TM of mares. Multiple comparisons showed statistically highly significant differences among lines. Again lines Pietrosu and Prislop (150.17 cm) exhibited the highest values and line Polan (144.14 cm) the lowest. Multiple comparisons showed that Hucul horses bred in Slovakia (148.63 cm) exhibited the higher values of the TM as Hucul horses bred in Hungary (146.56 cm). Between the highest and lowest average value the difference is more than 2 cm. This fact is not in agreement with the highest and lowest average value of the SM (difference is about 0.9 cm). TM is largely influenced by the HG, which, as we can see in the chapter below, is significantly higher in Hucul horses bred in the Slovakia.

Comparisons of the heart girth

Analysis showed that the effect of the age and gender were not statistically significant on HG. Effect of line was statistically significant and environment was statistically highly significant on HG. With the help of multiple comparisons we found out that Hucul horses bred in Slovakia (181.79 cm) exhibited markedly higher values of the HG as Hucul horses bred in Hungary (166.49 cm). Even though the GLM method showed that the line had a statistically significant effect on the heart girth, multiple comparison did not show anything. In the present study the authors gives at least the basic average values of the lines, because the difference between them is relatively big (between the highest and lowest average value the difference is 11.95 cm). Here again the lines Pietrosu and Prislop reached the highest average value of HG and the line Polan the lowest (176.88 and 164.93 cm, respectively).

Comparisons of the circumference of the shank

Analysis showed that the effects of the age and line were not statistically significant on the circumference of the shank. On the other hand, multiple comparisons showed statistically highly significant differences among the gender and environment. Hucul horses bred in Slovakia (18.51 cm) exhibited lower values of the CS as Hucul horses bred in Hungary (19.32 cm). With the help of multiple comparisons we found out that Hucul mares (18.85 cm) exhibited the lowest values of the CS and stallions (19.71 cm) and geldings (19.86 cm) the highest. A similar conclusion was also present by Matoušová-Malbohanová et al. [8], when comparing the body conformation between Hucul horses bred in the Czech Republic and in Poland and Purzyc et al. [10], when comparing the body conformation of 243 Hucul horses bred in Poland. They discovered differences in the CS based on the effect of the gender. Here again we see differences between stallions and mares. The mares have a lower CS than the stallions. Sobotková et al. [11] discovered statistically highly significant differences in the CS between the genders of the Old Kladrub horses (the CS of stallions was statistically significantly larger by 0.6 cm than the CS of mares) as well as Simčič et al. [9] who measured the primitive breed of Posavje horse in Slovenia and Croatia (the CS of stallions was statistically significantly larger by 2.1 cm than the CS of mares).

Hippo-metrical indices

Comparison analysis revealed that the gender and line have a significant effect on the IBC of Hucul horses. In warm-blood breeds this index ranges roughly around 100, in heavy horses around 109 [12]. In Hucul horses this index ranges within these two values. Multiple comparisons showed statistically highly significant differences, particularly among the gender. The stallions (100.37) have a lower IBC than the mares (106.04). A similar conclusion was also present by Matoušová-Malbohanová et al. [8], when comparing the body conformation between Hucul horses bred in the Czech Republic and in Poland – Hucul mares had statistically significant higher of IBC than stallions. Even though the GLM method showed that the line had a statistically significant effect on IBC, multiple comparison did not show anything. IBC is in relation with body dimension *diagonal length of body*. The higher the diagonal length of body is the higher is also IBC. Analysis showed that the effect of the environment was not statistically significant on diagonal length of body and IBC so we can suppose that Hucul horses bred in Slovakia and Hungary are proportional well-balanced.

Analysis showed that the effect of the gender and environment were statistically significant on IROB. The IROB decreased from heavy horses to the lighter breeds [13]. Multiple comparisons showed statistically highly significant differences among the environment, where Hucul horses bred in Slovakia (129.7) are robuster as Hucul horses bred in

Hungary (119.62). IROB is in relation with body dimension heart girth, which was statistically significant in our work also. HG of Hucul horses bred in Slovakia was statistically significantly larger by 15.3 cm than the HG of Hucul horses bred in Hungary so higher average value of IROB in Slovakia´s Hucul horses is not surprising. Multiple comparisons also showed statistically highly significant differences among the gender, where mares (124.12 cm) exhibited the highest values of the IROB and stallions (119.556 cm) and geldings (118.47 cm) the lowest. A similar conclusion was also present by Matoušová-Malbohanová et al. [8], when comparing the body conformation between Hucul horses bred in the Czech Republic and in Poland; i.e. that Hucul mares were robuster as stallions and Purzyc et al. [10] reached the same conclusions; i.e. that adult Hucul mares bred in Poland had a larger heart girth and smaller dimension of the bone than stallions. Furthermore, they consider the hypothesis that subsequent pregnancies in mares additionally transfer some of the function of the thoracic diaphragm, through indirect pressure, to inhaling muscles of the chest; this could result in greater arching of the ribs, and by extension – greater circumference of the chest, in mares. It is therefore likely that Hucul mares are more robust and deeper than stallions which are bonier and which become considerably stronger after castration.

By means of multiple comparisons we discovered that the environment has a significant effect on the index of compactness. The most compact horses are bred in Slovakia. ICOM is in relation with body dimension heart girth, which was higher in Slovakia´s Hucul horses.

Comparative analysis established that the gender and environment had a significant effect on the index of boniness of Hucul horses. Multiple comparisons detected statistically highly significant differences between the genders. Mares exhibited the lowest values of the IBON and stallions and geldings the highest. When comparing the body conformation of Hucul horses bred in the Czech Republic and in Poland Matoušová-Malbohanová et al. [8] reached the same conclusions; i.e. they found differences between stallions and mares where stallions had a higher IBON than mares. Multiple comparisons also revealed statistically highly significant differences among the environment. The index of boniness was higher in country which also exhibited the highest values in the circumference of the shank so Hucul horses bred in Hungary (13.88) exhibited higher values as Slovakia´s Hucul horses (13.2).

Conclusion

The objective of the present study was to analyse the effect of the age, line, gender and the environment on the body conformation of Hucul horses bred in some herds in the Slovak Republic and in Hungary. Most of the statistically significant differences appeared when analysing the effect of the environment and gender. Out of the 8 measured body dimensions and indices 6 were statistically highly significant in both effects. Hucul horses bred in Slovakia exhibited higher average values in almost every body dimensions and indices. From the results it can be assumed that Slovakia´s Hucul horses are higher, wider and they are robuster and more compact as Hucul horses bred in Hungary which are bonier. The effect of the environment embraces not only the environment of the horse, but also the technique and technology of rearing. The effect of the gender showed important statistical differences; i.e. mares are deeper and more robust than stallions. Stallions are bonier and after castration they become considerably stronger but do not increase their height any more. The line has a significant effect on the HG and IBC and highly significant effect on the SM and TM. Horses of the Prislop and Pietrosu line achieved the highest average values and Polan line the lowest. The effect of the age was not significant.

The results indicate that there are certain differences among the populations of Hucul horses from measured herds in Slovakia and Hungary. To raise the standard and improve the herd the authors recommend, in particular, a higher level of selection and breeding to be implemented as well as to change the conditions of rearing the Hucul horses to accommodate the demands of the horses and to avoid changing their precious conformation due to unfavourable conditions. Further recommendation is to harmonise the standard of breeding the Hucul horses within the HIF (Hucul International Federation) (to be identical for all countries where this horse is bred) and to agree on where the breeding should be headed. The Hucul is a horse resistant to harsh conditions, undemanding, easy to feed, healthy, calm with good disposition and we should do our utmost to preserve it in this condition for the future generations.

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