

## **ZOOMETRIC INDICES IN SILESIAN HORSES IN THE YEARS 1945–2005\***

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### **Abstract**

**The aim of the present work was to analyse biometric parameters of the Silesian horse population over a period of 60 years. The research material consisted of almost 11 000 horses. The post-German breeding material was accepted as the basis of the breed, and then the project traced the changes that the population underwent as a result of inconsistent breeding policy. Zoometric indices were found to vary considerably over the years and there was a definite reaction to breeding selection, leading to changes in animal type during a short period of time.**

**Key words:** horses, Silesian breed, breeding, selection, measurements, indices

Along with the decrease in the utilization of horses in agriculture and transportation, their usefulness in sport and recreation has been put forward as the prime reason why numerous horse breeds were transformed in that direction and lost their original characteristics (Thoren et al., 2008). Rare breeds avoided smaller or larger degrees of blood from Thoroughbreds remaining in pure breeding (Thirstrup et al., 2008). The Oldenburg horses – the German carriage breed from which the Silesian breed originates – were transformed into modern sport horses (WBFSH/FEI world rankings, 2010; Association of Breeders of Oldenburg Horses, 2010). Also, the Silesian breed was subject to numerous changes (Walkowicz et al., 1995 a, b; Walkowicz, 2000; Ząbek et al., 2003).

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The breeding of a heavy warmblood horse within the boundaries of German Silesia started at the end of the 19th century, when Oldenburg and East Friesian stallions were introduced to this area in order to create a speedy and sturdy carriage breed, useful for both agricultural and army purposes, e.g. in horse artillery (Hummert, 1942). By the Second World War this type of heavy warmblood horse (i.e. strong and calibrated, with a high weight, distinct gaits and calm character) was established in the Silesia region.

A considerable part of the breeding material became extinct or was evacuated during the war; however, it is estimated that about 5000 Silesian-type horses remained in the territories of Silesia and Lower Silesia. Most of them had no documented pedigree, and the origins of the current Polish breed were selected from amongst them (Rozwadowski, 1960). The mean characteristics of horses from that period were 160 cm (height at withers), 201 cm (chest circumference) and 23.4 cm (cannon circumference) for stallions, and 158.7 cm, 195.6 and 22.2 cm, respectively, for mares.

In the years 1945–1949 the number of horses tended to increase, as a result of which the material of varying quality was introduced to the breeding. In 1950–1955, as a result of political changes, part of the population was eliminated from the breeding and used as work horses. The plan for the consolidation of the Silesian breed as an agricultural horse was formed in 1956. At that time the average dimensions were 158.5 cm, 196 cm and 23.5 cm for stallions and 157 cm, 193 cm and 22 cm for mares. The transformation of the breed into an “economical” horse (height under 155 cm) that was supposed to be a complementary carriage force in mechanized agricultural holdings started in 1964 (Detkens, 1965). Concurrently, the Thoroughbred was added and the Wielkopolski breed was introduced. Strict selection, with respect to lowering height led to the elimination of numerous calibrated horses from breeding, and as a consequence the average characteristics during the early 1970s were 154 cm, 193 cm and 22.5 cm for stallions (155 cm, 192 cm and 21.6 cm for mares), and individuals of a height of 150 cm or less were often observed. Because such small horses appeared to be useless in agriculture, the breeding plan was changed again in 1969, establishing the desired height at a level of 155–158 cm. Still in 1972 the characteristics of the population averaged 156 cm, 191 cm and 21.8 cm. The lack of sales caused Silesian horse breeding to become unprofitable and the number of horses decreased rapidly.

Interest in Silesian horses returned when in the mid-1970s the Anglo-Silesian half-breds exported as saddle-horses for heavier riders became popular in West European countries. The popularity of “Polish hunters” caused the mass crossing of Silesian mares with Thoroughbred stallions.

In the mid-1980s four stallions of the Schweres Warmblut breed (heavy warmblood horse) were brought from Germany with the aim of improving the carriage characteristics of Silesian horses (Walkowicz, 1995). They were taller and of a lighter type, were used on a mass scale, and thus dominated the Polish breeding in less than two decades. In 2000 the final division of the Silesian breed into two types, i.e. an old one, aimed at sport carriages and wide-ranging usage, and a new one, in a saddle and sport carriage type, was introduced. The desired characteristics, depending on the type, were as follows (cm):

Old type	Height at withers	Chest circumference	Cannon circumference
Mares	158–168	190–210	22.5–23.5
Stallions	160–170	190–210	23–24
New type			
Mares	162–168	185–200	21.5–22.5
Stallions	164–170	190–200	22–23

In view of the frequency of breeding programme changes and the concurrent selection based mainly on exterior features, using interbreed crossing, it is difficult to rate Silesian horse breeding as a stable one and to expect an even population. However, the analysis of the effects that the subsequent changes led to seems to be an interesting issue.

The aim of the present work was characterization of zoometric traits of Silesian horses over a period of 60 years, and an attempt to determine the rate of the population reaction to the changes in breeding programmes in view of the selection methods used.

### Material and methods

The research material used in this study consisted of 10 966 Silesian and Oldenburg horses used in Polish breeding after the Second World War. Information from the Silesian horse database, based on breeding documentation (mare and stallion card files) from Local Horse Breeders' Associations was used in the study. The dimensions measured at the age of 2.5 years with an accuracy of 1 cm (height at withers, chest circumference) and 0.5 cm (cannon circumference) and point-scale estimation (0–100 points) were taken into consideration. The analysed population was divided according to sex, year (decade) of birth and breed group.

The horses were grouped according to years (decades) of birth:

- I – born before 1949,
- II – born in the period 1950–1959,
- III – born in the period 1960–1969,
- IV – born in the period 1970–1979,
- V – born in the period 1980–1989,
- VI – born in the period 1990–1999,
- VII – born in the period 2000–2005.

Moreover, the following breed groups were established:

- Silesian – purebred Silesian horses,
- SP – progeny of Warmblood ancestors,

SW – progeny of Schweres Warmblut ancestors,

SPSW – progeny of Warmblood and Schweres Warmblut ancestors.

Basic zoometric parameters were analysed, i.e. height at withers, chest circumference, cannon circumference, point-scale estimation and build indices, calculated according to the following formulae:

**Massiveness index** = (chest circumference / height at withers)  $\times$  100

**Boniness index** = (cannon circumference / height at withers)  $\times$  100

Basic descriptive statistics of analysed traits followed by statistical analysis using the non-parametric Kruskal-Wallis test were conducted. In addition, a post hoc multiple comparison test were performed using the Nemenyi-Damico-Wolfe-Dunn (NDWD) test (Hollander and Wolfe, 1999). The normality of the distribution of analysed traits was checked with the Shapiro-Wilk test (Woolson, 2002; Agresti and Franklin, 2007). All statistical tests were conducted in environment R<sup>1</sup>.

## Results

Basic statistics for the population demonstrated a moderate range of mean zoometric traits, with very high extreme values (Figure 1). The highest span was characteristic of chest circumference, where the difference between the extreme measurements was 80 cm for mares and 70 cm for stallions. Taking into consideration the sex of the horses analysed, it was demonstrated that stallions were characterized by a smaller range of characteristics.

When analysing the values of zoometric traits in consecutive decades, it was found that the most dynamic changes were related to the height at withers; for stallions, the mean value first decreased by about 5 cm and then increased by 10 cm (Table 1). For comparison, the present-day Silesian horse is 5 cm higher, which is reflected in a decrease in the massiveness index from 123.1 to 121.7 for mares and from 125.1 to 120.3 for stallions. The systematic increase in point-scale estimation (from 69.7 to 78.5 for mares and from 76.1 to 79.3 for stallions) proves that the population quality has improved.

Analysis of the influence of both factors (decade and sex) on the values of the analysed zoometric traits showed the predominance of sex influence in terms of cannon circumference and boniness index, while the decisive variable for height at withers and massiveness index was the decade (Figure 2).

Crossbreeding with Thoroughbred, Warmblood and, during the last three decades, Schweres Warmblut horses, corresponded to the tendencies of Silesian horses upgrading, with almost 80 percent of horses having ancestors of these breeds over the last decade (Figure 3).

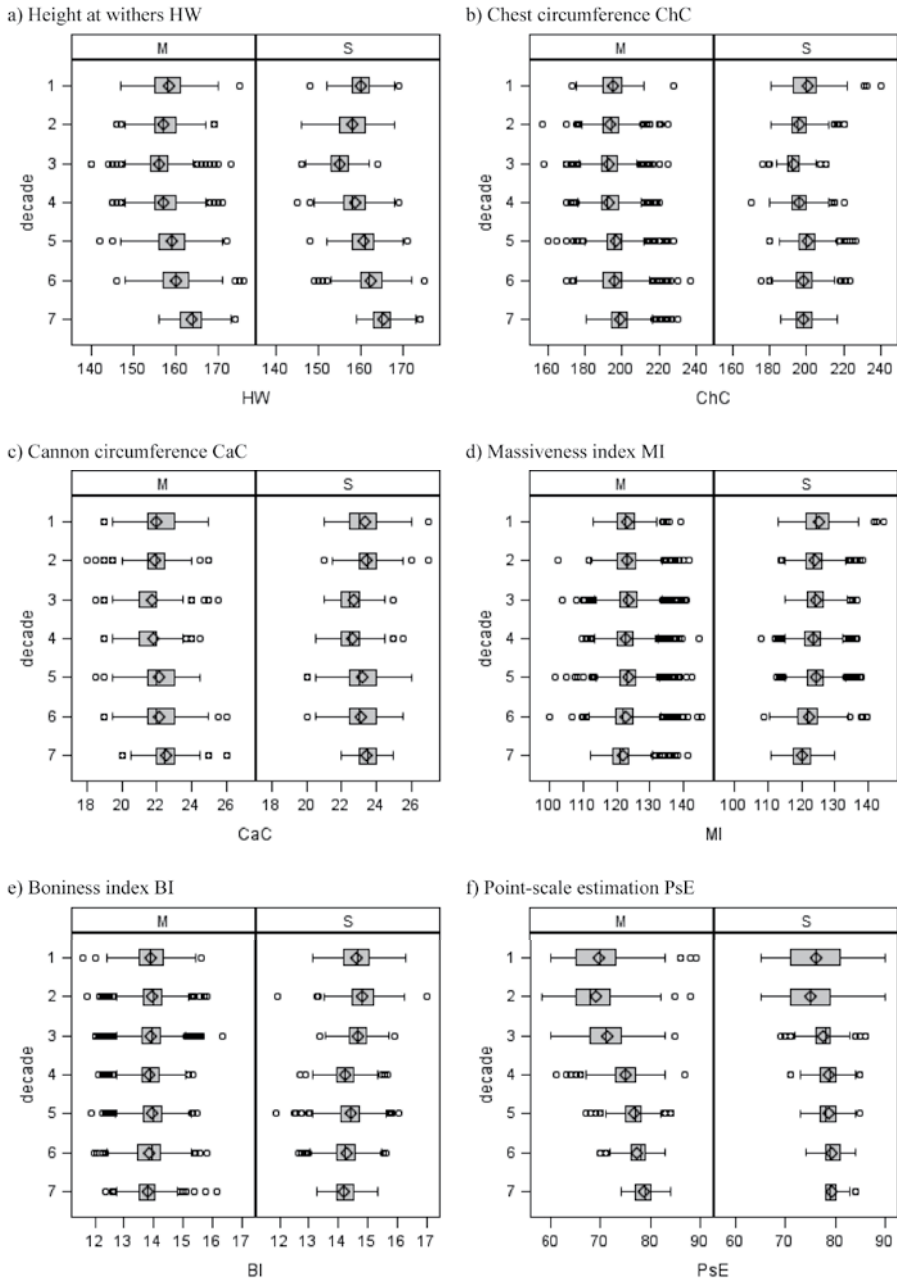


Figure 1. Characteristics of zoometric traits of Silesian horses in consecutive decades

Table 1. Basic zoometric parameters of the population in consecutive decades

Decade	N		Height at withers (cm)		Chest circumference (cm)		Cannon circumference (cm)		Massiveness index		Boniness index		Point-scale estimation	
	M	S	M	S	M	S	M	S	M	S	M	S	M	S
I	286	114	158.37	159.96	195.04	200.23 abc	21.99 a	23.33 abc	123.13 abcd	125.14 abc	13.88 abcd	14.58 a	69.75 a	76.14 ab
II	1092	327	157.15 a	157.98	193.71	195.97 d	21.90 a	23.42 ad	123.23 ae	124.03 ade	13.93 ae	14.81	69.05 a	74.88 a
III	1959	245	156.02	154.99	192.64 a	193.13	21.69	22.74	123.44 bef	124.58 bdf	13.90 b	14.67 a	71.17	77.48 b
IV	1382	452	157.16 a	158.71	193.03 a	196.05 d	21.77	22.59	122.80 c	123.51 e	13.85 cf	14.23 bc	75.05	78.61 c
V	1643	806	158.99	160.75	196.58 b	200.09 a	22.15 b	23.15 be	123.62 df	124.46 f	13.93 de	14.40	76.55	78.60 c
VI	1438	674	160.08	162.36	196.21 b	198.30 be	22.13 b	23.13 e	122.54	122.13	13.83 f	14.24 bd	77.31	79.32 d
VII	431	117	163.59	165.03	199.14	198.45 ce	22.54	23.45 cd	121.71	120.32	13.78	14.21 cd	78.57	79.27 d
Average	8231	2735	158.14	160.11	194.68	197.80	21.96	23.06	123.08	123.54	13.89	14.41	74.07	78.19

a, b, c, d, e, f – values in columns with the same letters are not different ( $P < 0.05$ ).

M – mares, S – stallions.

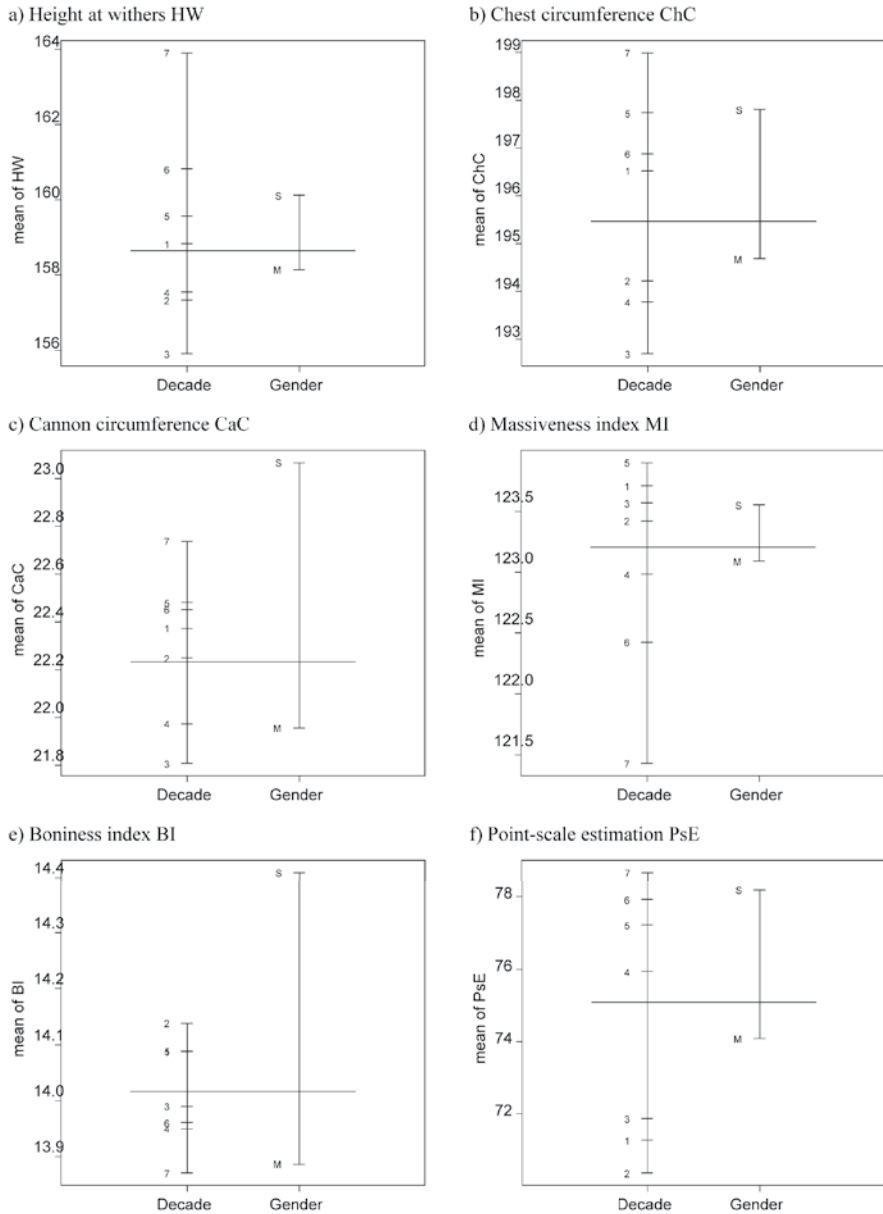


Figure 2. The influence of decade and sex on the values of zoometric traits in Silesian horses

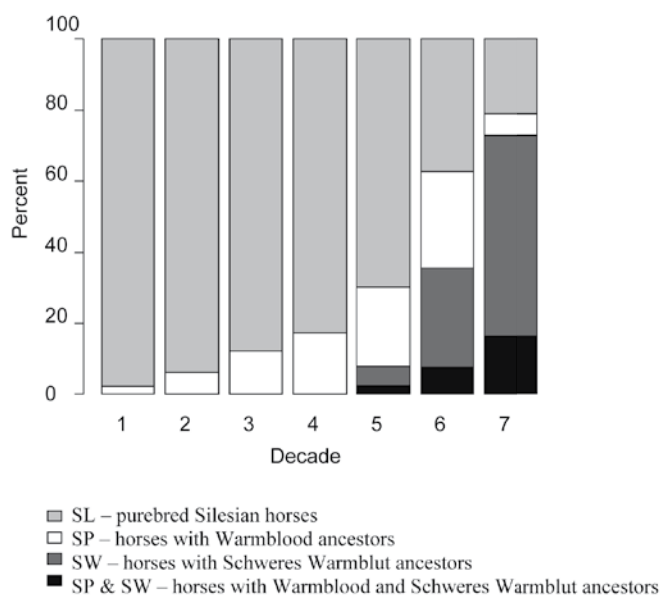


Figure 3. The contribution of halfbred horses to the Silesian population in consecutive decades

## Discussion

It was demonstrated that the changes in zoometric traits in consecutive decades correspond to the changes in the breeding programme. The most distinct was the introduction of an “economical” horse in the 3rd decade, and the rate at which the characteristics decreased proves the application of strict selection. The highest values for height at withers were observed in the case of differences between the 3rd decade and the other decades, which is understandable since strict selection aimed at decreasing the horse characteristics was applied during that period. Differences concerning chest and cannon circumference were less distinct, and the mean values of the last decades are close to the significance limit.

The least number of significant differences was observed for massiveness and boniness indices, and in both cases there were clear tendencies towards the decrease of their value in the latter decades. According to the obligatory breeding programme, since 2000 the Silesian breed has been managed in a two-way manner: part of the population is aimed to be maintained in an old, heavier type, and there is the possibility that the programme assumptions may not be fulfilled.

The analysis of mean values of the sum of point-scale estimation demonstrated their systematic, highly significant increase, from 71 points in the 1st decade to 78 points in the 6th and 7th decades, while in the latest decades, the differences between means are close to significance limits.



As may be concluded, there have been numerous changes during the 60 years of Silesian horse breeding in Poland, resulting from the changeable breeding policy. Initially, the breed was not appropriately appreciated by immigrant settlers who were used to small, light horses with minimal feed requirements (Prawocheński, 1953; Detkens, 1965). The political changes in Poland also had an impact on Silesian horse breeding in the form of the changes in breed model and destination. The idea of transforming the breed into small, economical horses with minimal feed requirements, aimed at supporting carriage force in large farms, appeared to be less fortunate. Selection, which excluded all individuals considered too large from the breeding, led to a drastic decrease in their size as well as body weight and suitability for work. Small horses were useless for work in agriculture and transportation, and for that reason they were not required.

A number of valuable individuals from meritorious Oldenburg and Silesian lines were lost irreversibly before that mistaken decision was withdrawn. The return to the old type was facilitated by the fact that some of the breeders obtained the decrease in horse characteristics by poor foal feeding, which meant they did not reach their full height but maintained the genetic potential. The progeny of these horses, when fed properly, regained the size typical of the breed. It took almost twenty years to level the "economization" effects, and in the meantime the Silesian breed underwent a decline, since breeding became unprofitable and unreliable.

The crossbreeding of Silesian horses with warmblood breeds in order to obtain the so-called Polish hunter-saddle horse, which was aimed for a heavier rider and for export purposes, was accepted as a solution for decreased demand for Silesian horses. After the initial successes, the crossbreeding on a mass scale started, mainly in national breeding, while part of the progeny were again crossed with Thoroughbred or Warmblood stallions. The assumption of treating the progeny of Thoroughbred stallions as pure Silesian horses was accepted concurrently. As a result, the Silesian horse lost its original type, and moreover its nutritional and environmental requirements increased (Walkowicz, 2000).

The next stage was the introduction of German blood of the Schweres Warmblut breed in order to increase the size and calibre of Silesian horses, but this did not produce the desired results (that breed, which originated from Oldenburg horses and thus had common origins with the Silesian breed, represented a lighter type) (Ząbek et al., 2003; Zuchtverband für das Ostfriesische und Alt-Oldenburger Pferd, 2010). They were used on such a scale that during the two decades they completely dominated Polish breeding, and nowadays more than half of all Silesian horses have ancestors of that breed in their pedigrees. Since they represented the lighter type than the Silesian horse, they had a significant impact on the value of zoometric indices in the 6th and 7th decades.

At the end of the 1990s the import of Schweres Warmblut horses was abandoned (Walkowicz, 2000). That place was filled with a conservative breeding programme, followed by the division of the breed into old and new type, differing in the contribution of Thoroughbred ancestors (the old type allows four Thoroughbred ancestors in the third generation, while the new one allows six) and use (the new type is to be

maintained in a sport type, while the old type as multipurpose and carriage) (Program Hodowli, 2007).

Currently the population of the Silesian breed is about 2500 horses, with a small part remaining as the old Silesian type (it is estimated that the proportion of horses of pure Silesian pedigree does not exceed 20%) and others having Thoroughbred or Schweres Warmblut ancestors in their pedigree (Cholewiński *et al.*, 1998). Considering that the system of performance value assessment prefers the light individuals, further exterior changes of the breed should be expected (Jodkowska *et al.*, 1999).

In conclusion, Silesian horse breeding in Poland may be an example of the influence of frequent changes of programme aims and assumptions on the breed population, especially those realized by direct selection of traits and crossbreeding. Both methods allow the desired results to be obtained quickly, especially with regard to exterior features, while in the case of genetically consolidated breeds the selection gives more stable results. As demonstrated in the results of the present study, the significant changes of exterior features may be obtained during one decade, i.e. two generations, and unless interbreed crossing is introduced, the effects may be reversible.

### References

- Agresti A., Franklin C. (2007). *Statistics: the art and science of learning from data*. Pearson Prentice Hall.
- Association of Breeders of Oldenburg horses. Der Oldenburger. [http://www.oldenburger-pferde.com/pferde/index\\_12.php](http://www.oldenburger-pferde.com/pferde/index_12.php)
- Cholewiński G., Cothran E.G., Walkowicz E. (1998). Genetic analysis of major sire lines within the Silesian horse breed from Poland. *Anim. Genet.*, 29 (Suppl.), p. 16.
- Detkens S. (1965). Present situation and abilities of progress of Silesian horses breeding (in Polish). *Biul. ZHDZ PAN*, 9, 124 pp.
- Hollander M., Wolfe D.A. (1999). *Nonparametric statistical methods*. New York, Wiley, 526 pp.
- Hummert G. (1942). *Die Wichtigsten Stutenstämme des Oldenburger Pferdes*. Institut für Tierzucht und Molkereiwesen der Universität Bonn, H 16, 194 pp.
- Jodkowska E., Walkowicz E., Geringer H. (1999). The overall performance and prospects of use of Silesian stallions from Książ Depot in European breeding scheme of heavy warmblood horses. *Proc. 50th Annual Meeting of EAAP*, Zurich, 22–26.08.1999, p. 339.
- Program (2007). *Programme of the Silesian horse breeding* (in Polish). PZHK, Warszawa.
- Rozadowski Z. (1960). *Silesian horse and its breeding* (in Polish). PWRiL, Warszawa, 147 pp.
- Schweres Warmblut. *Die Geschichte der Schweren Warmblutes* <http://www.pferde-sachsen-thueringen.de/pferdezuchtverband/rassen/schweres-warmblut/>
- Thirstrup J.P., Pertoldi C., Loeschcke V. (2008). Genetic analysis, breed assignment and conservation priorities of three native Danish horse breeds. *Anim. Genet.*, 39, 496–506.
- Thoren E., Jorjani H., Philipsson J. (2008). Connectedness among five European sport horse populations. *Livest. Sci.*, 118: 147–156.
- Walkowicz E. (1995). Present situation and prospect of the Silesian horse breeding (in Polish). *Proc. Int. Conf.: Prospect of the regional horse breeding. Silesian horse*, Wrocław, 18–20.09.1995, pp. 17–24.
- Walkowicz E. (2000). Usage of Silesian horses in competition horses production (1980–1995) (in Polish). *Zesz. Nauk. AR Szczecin, Zootechnica*, 40: 277–284.
- Walkowicz E., Praska U., Małysz W. (1995 a). Influence of alien breeds on biometrical parameters of the Silesian mares (in Polish). *Proc. Int. Conf.: Prospect of the regional horse breeding. Silesian horse*, Wrocław, 18–20.09.1995, pp. 45–48.

- W a l k o w i c z E., P r a s k a U., M a ł y s z W. (1995 b). Genetical structure of the Silesian horses in the Strzelce Opolskie stud (in Polish). Proc. Int. Conf.: Prospect of the regional horse breeding. Silesian horse, Wrocław, 18–20.09.1995, pp. 49–52.
- W o o l s o n R. (2002). Statistical methods for the analysis of biomedical data. Wiley.
- World Breeding Federation for Sporthorses. (2010). WBFSH/FEI world rankings <http://www.wbfs.org/?GB/Rankings/WBFSH%20rankings.aspx>. Accessed December.
- Z ą b e k T., D u n i e c M., B u g n o M. (2003). Genetic relationships between Silesian, Thoroughbred and Oldenburg horses based on DNA microsatellite polymorphism. Ann. Anim. Sci., 3, 2: 213–224.

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### Wskaźniki zoometryczne koni rasy śląskiej w latach 1945–2005

#### STRESZCZENIE

Celem pracy była charakterystyka kształtowania się parametrów biometrycznych pogłowia koni rasy śląskiej, poczynwszy od wczesnych lat powojennych do terażniejszości. Materiałem badań było blisko 11 tysięcy koni. Jako podstawę rasy przyjęto ponemiecki materiał hodowlany, a następnie prześledzono zmiany, jakim podlegało pogłowie rasy, wskutek zmiennej polityki hodowlanej. Wykazano dużą rozpiętość wskaźników zoometrycznych na przestrzeni lat oraz zdecydowaną reakcję na selekcję hodowlaną prowadzącą do zmian typu użytkowego w krótkim okresie czasu.