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THE BREEDING VALUE OF WIELKOPOLSKI HORSES BELONGING TO PARTICULAR STALLION LINEAGES IN THE SUCCESSIVE VOLUME OF THE STUD BOOK, AS EVIDENCED BY THEIR BODY CONFORMATION AND PERFORMANCE TRAITS

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Abstract. The study of the body conformation and performance traits of the 11 376 Wielkopolski horses registered in the six successive volumes of the Stud book identified 24 principal stallion lineages [subsequently divided into 4 origin groups (lineage types – "Trak./East–Pruss", (Trakehner/East–Prussian), "Han." (Hanoverian), "xx" and "o/xo"] which comprised 10 630 horses. The particular lineages were represented by highly different numbers of horses, with a tendency for some of them to gradually decline ("Trak./East–Pruss." type), stagnate ("o/xo") or distinctly progress ("xx" and "Han."). A considerable number of statistically significant differences were found in the mean values of the body conformation and performance trait indices of the analysed horses (chiefly at $P < 0.01$) between the lineage origin groups, which suggests a high degree of breeding influence on the development of Wielkopolski performance traits. Moreover, emphasis was laid on the evident need for maintaining the existing lineages in the Wielkopolski subpopulation covered by the gene pool protection program and creating new lines and lineages in order to improve the principal population of the breed – though, exclusively on the basis of sires that pass onto their offspring body conformation and performance trait complexes which determine a high capacity

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potential of the offspring to meet the requirements of different purposes, forms and methods of the contemporary use of horses.

Key words: Wielkopolska breed horses, breeding value, families, horses studbook

INTRODUCTION

The analysis involved 11,376 Wielkopolski horses registered in the six successive volumes of the Stud Book ("Kwlkp"). 11,302 horses were classified in particular lineages. 24 principal lineages were identified. They were divided into 4 origin groups: "Trak./East–Pruss." (Trakehner/East–Prussian), "Han." (Hanoverian), Thoroughbreds ("xx") and Arabian or Anglo-Arabian Half-Breds ("o/xo"). These comprised altogether 10,630 horses. The lineages were represented by highly different numbers of horses (in the respective "Kwlkp" volumes) with different progress or regress tendencies. Moreover, the horses in the lineages had different collective and individual breeding value means within the scope of the analysed body conformation and performance traits (wither height, chest and cannon circumference, "bulkiness" and "boniness" indices, comprehensive body conformation assessments and performance test results), which produced a pattern of statistical significance in many cases. We identified a need for maintaining the existing lineages with a breed specific gene pool protection program and developing new lines and lineages to satisfy the current breeding requirements and applications.

Contemporary breeding of hot-blooded half-bred horses that are fit for high performance in different disciplines of equestrian competition sports (mainly horse-riding) is generally based on skilful reproductive selection in which "line maintenance" (or fostering lineages of distinguished stallions and families of outstanding mares) plays a very essential role, whereas the formal belonging of particular horses to a breed is rather of secondary importance. The weight of the problem of saddle horse breeding and production for sports purposes can be seen e.g. in the attempts at standardising (in an international scale – within the INTERSTALLION system – 3, 18) monitoring and evaluation methods with respect to breeding value based on the traits under selection. The abovementioned stage in breeding management is of particular importance. Ongoing improvements in its implementation (based on the application of specific variants of the BLUP method) led to incredible breeding development within the area of quantitative production parameters of farm animal species (e.g. dairy cattle, poultry and pigs). As regards horses – not production but predominantly service animals (whose "ergogenic" capacity is definitely difficult, if not impossible, to identify quantitatively), studies aimed at assessing their breeding value were started in the 1880s. However, the studies required an adequate adaptation of the genetic and populational methods [Tavernier

1988, Tavernier 1991] that are still being improved [Ricard and Legarra 2010].The studies produced a great number of publications on the breeding value of French [Langlois et al. 1983, Tavernier 1990], Belgian [Janssens et al. 2007], Spanish and Swedish [Viklund 2010] sports horses, as well as that of French [Langlois et al. 1983, Tavernier 1989], Dutch, Swedish [Árnason 1984] and Norwegian trotters. Apart from performance parameters, the body conformation component of breeding value was also analysed in particular horse breeds, e.g. in German saddle horses [Weymann et al. 1993] and Trakehner mares and foals [Preisinger 1991]. Recent years have seen a continuation of this type of research. Among others, the studies dealt with the assessment of the breeding value of Belgian sports horses [Janssens 2007], Swedish warmblood horses [Viklund 2002], Spanish sports horse breeds [Gómez et al. 2011], Spanish trotter horses [Gómez et al. 2011] and Slovak warmblood horses [Halo et al. 2008].

Despite the fact, in hippological science and research literature there is a shortage of publications on "lineage breeding" – concerning "leading" populations of riding sports horses – that contain lists of names of outstanding sires or stud mares. Such publications have sometimes appeared in connection with horse populations that are "in decline" (e.g. the Old Kladruby horse – [Capková 2008]). Nevertheless, the question of appurtenance to male or female lines has already been dealt with – e.g. papers on the existence of maternal lines (identified with mtDNA analyses) in populations of Polish full-blooded Arabians (Polish Arabian Horse) [Głażewska et al. 2007] and Lipizzan Horse populations [Kavar 2002, Zechner et al. 2002], as well as entire "blood lines" fostered within the Italian Haflinger population [Sabbioni 2007].

It should be noted that a frequent subject of contemporary research is the genetic structure of various horse breeds maintained worldwide – assessed using a variety of research methods – that included e.g.: saddle breeds of French race and sports horses [Moureaux et al. 1996], Spanish sports horses [Bartolomé et al. 2011], Trakehners [Teegen et al. 2009], Hanoverians [Schröder et al. 2010], Andalusian [Valera 2005] and Sicilian [Guastella et al. 2011] horses, the Lipizzan horse [Zechner et al. 2002], Franche-Montagne [Glowatzki-Mullis 2006], the Irish Draught Horse [McGahern et al. 2006], the King Ranch Quarter Horse [Dobson et al. 2010], as well as various breed populations of Spanish Celtic horses [Cañon et al. 2000], local Brazilian horse breeds [Silva et al. 2012], Chinese horses [Ling et al. 2011] and Indian Kathiawari [Koringa et al. 2008]. The type of study has also been applied to various populations of Norwegian (hot-blooded, primitive and cold-blooded) [Bjornstad et al. 2000] horses, as well as Austrian, Croatian and German draught horses [Druml et al. 2007] and cold-blooded Hispano-Breton horses [Pérez-Gutiérrez et al. 2008].

The above publications in the hippological literature only hint at the problem of the genetic analysis of the determination of body conformation and performance traits within different horse populations, since no means exist at present to discuss the issue in more detail.

Considering the above, the present study was an attempt at assessing the breeding value of Wielkopolski horses belonging to lineages started by outstanding sires, with a particular emphasis laid on body conformation and performance traits. The horses are registered in the successive volumes of the Stud Book [Wielkopolski Stud Book 1965, 1966, 1971, 1972, 1976, 1977, 1981, 1982, 1990, 1992, 1998, 2000] and were discussed in a previous article [Kaproń et al. 2013].

For the reasons signalled above, the basic aim of the present study was to determine the average level of breeding value of the particular lineages and reveal their rising or decreasing influence on the active breeding population, both the part covered by the improvement program and the part covered by the gene pool protection program.

MATERIAL AND METHODS

The study involved 11,376 horses (including 4354 stallions and 7022 mares) registered in the six successive volumes of the Wielkopolski Stud Book (37). Among the horses, 10,630 belonged to 24 lineages started by outstanding sires with significant influence on various Polish half-blooded horse populations. The identified lineages were divided into 4 types (depending on the breed or the breeding application of the particular lineage-founding sires): (1) of Trakehner–East–Prussian origin (abbreviated in the tables as "Trak./East-Pruss."), (2) of Hanoverian origin ("Han."), (3) of Anglo-Arabian origin ("o/xo") and (4) descendants of Thoroughbred sires ("xx"). The horses had been chiefly used in the development of the original breeds and penetrated into Polish half-blooded studs through their male progeniture. The first two lineage types also included Thoroughbred sires. However, they had not been extensively used in the development of the original breed. The particular lineages involved from 4 to 11 generations of Wielkoplolski horses.

The variance components (used for the assessment of the breeding value of the respective horses) were determined based on the REML method, and breeding value indices were calculated by means of the BLUP-Animal Model using PEST software [Gómez et al. 2011] in reference to previously presented animal models [Janssens et al. 2007] – in two profiles: for each separate body conformation or performance trait – marked as WHi; for all the analysed traits cumulatively – dividing the WHi for each trait with its standard deviation – adding up the results and designating the sum as WHo, i.e. "standardised general breeding value".

For reasons of clarity, the present study has forgone a detailed presentation of mean WHi values for the particular body conformation and performance traits of the Wielkopolski horses within each of the analysed lineages (named). It was limited, instead, to a presentation of the means for the origin/breed–specific lineage types. Moreover, the individual breeding value indices mainly served for the assessment of the comprehensive breeding value (WHo), based on the entirety of the analysed traits.

The indices of the body conformation traits of the analysed horses included [Kaproń et al. 2013]: body dimensions (wither height and chest and cannon circumferences, in cm), body structure indices ("bulkiness" and "boniness" – expressed as %% ratios of the above dimensions and wither height), as well as overall body conformation assessments (in pts). Performance traits were analysed exclusively on the basis of performance test results (obtained only for the stallions, i.e. actual parameters, whereas these traits were only estimated in the case of the mares by means of the BLUP method).

RESULTS

Twenty-four main lineages (comprising a total of 11,302 Wielkopolski horses) classified in the 4 origin types were identified in the population under analysis (Table 1).

The analysis of the material revealed that horses of Trkehner/East-Prussian origin were clearly numerically dominant as compared with the other types and constituted 55% of the total number of the Wielkopolski horses. The second most numerous group was composed by Thoroughbred lineages (ca 30% of the population), whereas descendants of Hanoverian and Anglo-Arabian half-blooded stallions constituted only a little over 4% of the total, respectively. A large part of the lineages in question date back to as early as the beginning of the 2nd half of the 19th century, as they have been continued by the (exclusively male) progeniture of the founding sires of separate sub-lineages whose identification is however impossible within the scope of the present study. The continuation of the lineages has been, however, highly variable in the population of Wielkopolski horses, as the successive Stud Book volumes contain definitely decreasing numbers of horses belonging to the Trakehner/East–Prussian lineages (Vol. I – ca 71%; Vol. VI – ca 27%). Simultaneously, a clear numerical progress can be observed in the progeniture of the Thoroughbred (Vol. I – ca 8%; Vol. VI – ca 54%) and Hanoverian lineages (Vol. I – ca 3%; Vol. VI – ca 11%). The Anglo-Arabian lineages were found, in turn, to have "stagnated" (Vols I and VI – a little over 4%, respectively). The data in Table 1 show an evident variability in general breeding value means for all the body conformation and performance traits (analysed cumulatively as

Table 1. Changes in the numerical strength and breeding value indices of the particular lineage types in the successive Stud Book volumes

Tabla 1. Zmiany liczebności oraz wskaźników wartości hodowlanej koni należących do poszczególnych typów rodów w kolejnych tomach księgi stadnej

Lineage type Typ rodów			Kwlkp volume/Cumulative analysis of the traits Tomy Kwlkp/Cechy w ujęciu łącznym						The number of horses in the clans Liczba koni w grupie	
			I	II	III	IV	V	VI	n	%
Trak/East-Pruss Trak/wsch.pr.	Lineages Rody	n	1874	1362	940	796	664	655	6291	55.75
		%	71.17	68.82	64.03	59.76	42.13	27.43	–	–
		BVo	2.83 ABC**	3.73 AB	3.83 AB	3.87 ABC	4.43 aBC	4.33 ABC**	–	–
		S	4.30	4.64	4.17	4.34	4.47	4.03	–	–
	Stallions Ogiery	n	861	482	338	294	246	254	2475	21.75
		BVo	2.83	4.35	4.26	3.96	4.75	4.56	–	–
		s	4.24	4.01	3.79	3.83	4.59	3.58	–	–
	Mares Klacze	n	1013	880	602	502	418	401	3816	33.5
		BVo	2.83	3.39	3.59	3.81	4.25	4.19	–	–
		S	4.35	4.92	4.35	4.62	4.39	4.28	–	–
Han	Lineages Rody	n	76	23	6	3	101	260	469	4.12
		%	2.89	1.16	0.41	0.23	6.41	10.89	–	–
		BVo	1.58 AD**	1.40 AC	2.33	–2.86 ADE	3.88 aDE	3.13 AD**	–	–
		S	5.11	5.54	2.85	2.42	4.12	4.12	–	–
	Stallions Ogiery	n	36	11	1	2	40	133	223	1.96
		BVo	0.94	1.27	1.73	–3.37	5.20	2.89	–	–
		s	5.18	3.26	–	3.20	3.00	3.70	–	–
	Mares Klacze	n	40	12	5	1	61	127	246	2.1
		BVo	2.15	1.51	2.45	–1.85	3.02	3.37	–	–
		S	5.04	7.19	3.17	–	4.53	4.52	–	–
xx	Lineages Rody	n	207	354	358	421	688	1281	3309	29.08
		%	7.86	17.89	24.39	31.61	43.65	53.64	–	–
		BVo	2.13 BE	3.59 CD	3.20 AC	3.08 BDF	2.79 BD	2.24 BDE	–	–
		S	4.48	4.16	4.37	4.17	4.22	4.19	–	–
	Stallions Ogiery	n	86	113	127	165	228	449	1168	10.3
		BVo	1.71	3.91	2.32	3.19	3.12	2.46	–	–
		S	4.40	3.64	3.78	3.77	4.13	4.05	–	–
	Mares Klacze	n	121	241	231	256	460	832	2141	18.82
		BVo	2.43	3.44	3.68	3.01	2.63	2.12	–	–
		s	4.53	4.38	4.60	4.42	4.26	4.26	–	–
o/xo	Lineages Rody	n	114	94	92	63	90	108	561	4.93
		%	4.33	4.75	6.27	4.73	5.71	4.52	–	–
		BVo	–0.68 CDE**	1.96 BD	2.03 BC	2.30 CEF	2.59 CE	2.97 CE**	–	–
		S	4.21	4.30	3.97	3.95	4.10	4.24	–	–
	Stallions Ogiery	n	51	28	26	21	28	41	195	1.71
		BVo	–0.48	2.72	2.20	2.16	3.42	2.31	–	–
		S	4.23	3.48	2.99	4.18	3.45	4.36	–	–
	Mares Klacze	n	63	66	66	42	62	67	366	3.2
		BVo	–0.84	1.63	1.97	2.37	2.22	3.38	–	–
		S	4.22	4.59	4.31	3.89	4.33	4.14	–	–

Means in rows (of columns: Volume I–VI) marked with the same letter differ significantly at: **P < 0.01 or *P > 0.05; means in columns marked with the same letter differ significantly at (uppercase letters) P < 0.01 or (lower case) P < 0.05.

Średnie w wierszach (z kolumn: tom I–VI) oznaczone tą samą literą różnią się istotnie przy (dotyczy to wyłącznie cech w ujęciu łącznym): **P < 0,01 lub *P > 0,05; średnie w kolumnach oznaczone tą samą literą różnią się istotnie przy (wielkie litery) P < 0,01 lub (małe litery) P < 0,05.

WHo) of the Wielkopolski horses from the particular lineage types within each Stud Book volume. Statistically highly significant differences between the WHo means of the particular lineage types were marked with the same letters in the successive Stud Book volumes (columns), whereas "conventional breeding progress" (i.e. differences between the WHo means of Vol. 1 and 6 horses) in the Wielkopolski population was marked as ** (highly significant at $P \leq 0.01$, in particular rows) and observed in almost all of the lineage types (apart from the descendants of Thoroughbred stallions).

The individual data of the horses within the particular lineage types (Table 2) revealed the highest WHo indices in the case of the offspring of the xxoo stallion Marten (4.64 – Anglo-Arabian lineages), followed by the progeniture of the xx stallion King Tom (4.16 – Trakehner/East-Prussian lineages), of the Hanoverian stallion Senatus (4.07 – Hanoverian lineages) and of the xx stallion Bay Ronald (3.51 – Thoroughbred lineages). Moreover, statistically significant differences in a variable arrangement of the dominant sex were identified in almost half of the analysed lineages between WHo means of the stallions and those of the mares. Thus, within the Trakehner/East-Prussian lineages, stallions representing the line of the following sires: xx Perfectionist – 1899, x East-Pruss. Dingo – 1895 and xx Gallinule – 1884 were highly significantly superior to the mares in the mean level of the WHo in a cumulative analysis of the traits. On the other hand, within the Hanoverian lineages, such a situation concerned only the offspring representing the line of the x Han. stallion Detektiv – 1922 (the stallions surpassed the mares), whereas the mares highly significantly surpassed the stallions in the lines of the x Han. stallion Senatus – 1958 and xx Uncle Pat – 1908.Within the WHo means for the full set of the body conformation and performance traits, a variable situation was also observed in the case of the horses representing Thoroughbred lineages among which the stallion descendants of the lines of the xx stallion Bay Ronald – 1893 and the xx stallion Tourbillon – 1928 highly significantly surpassed the lineage mares, whereas an opposite trend was identified in the line of the xx stallion Sterling – 1868. On the other hand, the female progeniture of the xo stallion Amur I – 1929 and X o Schagya – 1899, representing the Anglo-Arbian lineages, significantly surpassed the male offspring.

Table 3 contains WHo means determined both for the analysed traits cumulatively and separately for each trait. What can be observed in it are considerable and usually statistically highly significant differences between the origin- and breed-specific types of lineages (marked in each case with the same letters). The vast number of such differences – both in the cumulative analysis of the lineages and in the individual assessment of the stallions and mares – precludes a detailed discussion here. Thus, it was only possible to discuss the differences (marked as follows: * – significant at $P \leq 0.05$; ** – significant at $P \leq 0.01$) between the stal-

Table 2. Breeding value indices of (*Kwlkp* Vols 1–6): horses from the respective principal lineages

Tabela 2. Wskaźniki wartości hodowlanej uzyskane (w tomach I–VI Kwlkp) przez konie należące do poszczególnych rodów głównych

No. Nr	Lineage founder[1] Założyciel rodu[1]	Cumulative analysis of the traits Cechy w ujęciu łącznym										
		Lineage – Ród					Stallions – Ogiery			Mares – Klacze		
		n	%	BVo	S	n'	n	BVo	S	n	BVo	S
		Trak/East-Pruss – Trak/wsch-pr.										
1.	KING TOM xx, 1851	2204	19.37	4.16	4.31	919	877	4.20	4.13	1327	4.14	4.42
2.	PERFECTIONIST xx, 1899	2195	19.30	4.07	4.34	874	827	4.42A	4.03	1368	3.86A	4.51
3.	DINGO x, East-Pruss., 1895	765	6.72	2.63	4.53	360	316	2.98A	4.24	449	2.39A	4.72
4.	HECTOR xx, 1872	151	1.33	3.32	4.37	76	61	3.58	4.19	90	3.15	4.50
5.	OBELISK x, Beb, 1881	190	1.67	1.99	4.39	103	83	1.94	4.23	107	2.02	4.53
6.	RHAMSES xx, 1904	507	4.46	2.78	4.14	232	215	2.96	3.65	292	2.64	4.46
7.	MOEROS xx, 1886	219	1.93	1.69	3.91	93	73	1.46	3.76	146	1.81	4.00
8.	GALLINULE xx, 1884	60	0.53	0.81	3.46	36	23	2.31A	2.68	37	–0.12A	3.59
		Han										
9.	DETEKTIV Han., 1922	38	0.33	2.12	4.42	49	31	2.55a	4.50	7	0.19a	3.75
10.	FLING Han., 1911	279	2.45	3.22	4.29	171	127	3.32	3.89	152	3.13	4.62
11.	2458 SENATUS Han., 1958	75	0.66	4.07	3.43	43	36	3.49a	3.31	39	4.60a	3.48
12.	UNCLE PAT xx, 1908	77	0.68	1.03	5.17	44	29	0.32a	4.43	48	1.45a	5.57
		"xx"										
13.	BAY RONALD xx, 1893	686	6.03	3.51	4.41	285	233	4.11A	4.17	453	3.21A	4.50
14.	BEND OR xx, 1877	904	7.95	2.49	4.13	399	281	2.43	3.88	623	2.51	4.24
15.	STERLING xx, 1868	453	3.98	2.26	4.21	222	195	1.86A	4.08	258	2.57A	4.29
16.	VEDETTE xx, 1854	671	5.90	2.86	4.20	320	238	2.71	3.70	433	2.94	4.45
17.	TOURBILLON xx, 1928	413	3.63	1.63	4.00	176	154	2.06A	3.85	259	1.37A	4.07
18.	5971ANTIQUARIAN xx, 1961	34	0.30	3.78	3.92	17	16	3.65	3.58	18	3.90	4.30
19.	HURRY ON xx, 1913	148	1.30	3.69	4.48	62	51	4.06	4.23	97	3.49	4.61
		"o/xo"										
20.	3578 MARTEN xxoo, 1952	56	0.49	4.64	3.69	22	20	5.30	2.87	36	4.27	4.06
21.	251AMUR Ixo, 1929	49	0.43	1.68	3.47	19	15	0.70a	3.42	34	2.12a	3.46
22.	1019 RUMIAN m, 1936	72	0.63	0.19	3.59	22	18	0.43	3.40	54	0.11	3.68
23.	SCHAGYA X o, 1899	261	2.29	1.97	4.56	141	103	1.61a	4.30	158	2.20a	4.73
24.	1245 TRIPOLIS xo, 1911	123	1.08	0.99	4.14	48	39	1.38	3.79	84	0.81	4.30
Altogether – Łącznie		10630	93.44	61.58	99.56	4733	4061	63.83	92.31	6569	58.76	102.84

The means in rows (columns: Stallions and Mares): marked with the same letter significantly differ at (ref. cumulative analysis of traits only): uppercase – $P < 0.01$, lowercase – $P < 0.05$.

[1] Listed in the following order: breeding registration number (if assigned): name, breed or type abbreviation, year of birth;

n' – number of all the horses in a lineage, n – number of lineage horses registered in the Kwlkp. 278

Średnie w wierszach (z kolumn: ogiery, klacze) oznaczone tą samą literą różnią się istotnie przy (dotyczy wyłącznie cech w ujęciu łącznym): wielkie litery – $P < 0.01$, małe litery – $P < 0.05$,

[1] Podano w kolejności: hodowlany numer ewidencyjny (jeśli został nadany), nazwa, skrót określający rasę lub typ, rok urodzenia.

n' – liczba wszystkich koni w rodzie, n – liczba koni w rodzie wpisanych do Kwlkp. Objaśnienia skrótów użytych do określenia ras i typów koni umieszczono w rozdziale 2.

Table 3. Breeding value indices of (Kwlkp Vols 1–6): horses from the respective lineage types

Tabela 3. Wskaźniki wartości hodowlanej uzyskane (w tomach I–VI Kwlkp) przez konie należące do poszczególnych typów rodów

Lineage type	Lineages – Rody				Stallions – Ogiery			Mares – Klacze		
Typ rodu	n	%	BVo	S	n	BVo	S	n	BVo	S
Cumulative analysis of the traits – Cechy w ujęciu łącznym										
TEP	6291	55.30	3.63ABC	4.39	2475	3.82ABC**	4.13	3816	3.51ABC**	4.55
Han	469	4.12	2.90AdE	4.43	223	2.85AD	4.07	246	2.95AdE	4.74
xx	3309	29.09	2.70BdF	4.25	1168	2.76BE	4.02	2141	2.67BdF	4.38
o/xo	561	4.93	1.77CEF	4.32	195	1.77CDE	4.10	366	1.77CEF	4.45
Wither height – Wysokość w kłębie										
TEP	6291	55.30	0.11AB	1.09	2475	0.04AB**	1.09	3816	0.16AB**	1.09
Han	469	4.12	0.59AC	1.00	223	0.55AC	0.94	246	0.62AC	1.05
xx	3309	29.09	0.53BD	1.02	1168	0.52BD	1.03	2141	0.53BD	1.02
o/xo	561	4.93	0.20CD	1.22	195	0.13CD	1.24	366	0.23CD	1.21
Chest circumference – Obwód klatki piersiowej										
TEP	6291	55.30	0.51A	1.09	2475	0.55aB*	1.03	3816	0.49A*	1.12
Han	469	4.12	0.45B	1.04	223	0.42C	0.94	246	0.47B	1.12
xx	3309	29.09	0.48C	1.02	1168	0.47aD	0.93	2141	0.48C	1.07
o/xo	561	4.93	0.20ABC	1.07	195	0.15BCD	1.07	366	0.23ABC	1.08
Cannon circumference – Obwód nadpęcia										
TEP	6291	55.30	0.61ABC	1.07	2475	0.61ABC	1.05	3816	0.61ABC	1.08
Han	469	4.12	0.85ADE	1.14	223	0.89ADE	1.11	246	0.83ADE	1.18
xx	3309	29.09	0.43BDF	1.01	1168	0.46BDF	0.98	2141	0.42BDf	1.02
o/xo	561	4.93	0.27CEF	1.15	195	0.22CEF	1.11	366	0.30CEf	1.18
Chest circumference index – Obwód klatki piersiowej, indeks										
TEP	6291	55.30	0.43ABC	1.08	2475	0.55ABC**	1.04	3816	0.35ABC**	1.09
Han	469	4.12	–0.21AdE	1.03	223	–0.20Ad	0.91	246	–0.21Ad	1.13
xx	3309	29.09	–0.10Bd	1.05	1168	–0.10B	1.01	2141	–0.10B	1.07
o/xo	561	4.93	–0.01CE	1.20	195	0.01Cd	1.27	366	–0.02Cd	1.16
Cannon circumference indeks – Obwód nadpęcia, indeks										
TEP	6291	55.30	0.69ABC	1.05	2475	0.77ABCl**	1.04	3816	0.64ABC**	1.05
Han	469	4.12	0.51ADE	1.13	223	0.58ADE	1.11	246	0.44ADE	1.14
xx	3309	29.09	0.04BDF	1.04	1168	0.07BD	1.01	2141	0.03BDf	1.06
o/xo	561	4.93	0.17CEF	1.10	195	0.16CE	1.02	366	0.17CEf	1.14
Comprehensive body conformation assessment – Ogólna ocena pokroju										
TEP	6291	55.30	0.99ABC	1.06	2475	1.04ABC**	0.96	3816	0.96ABC**	1.11
Han	469	4.12	0.64ADE	0.84	223	0.59ADe	0.75	246	0.68Ade	0.92
xx	3309	29.09	0.83BDF	0.88	1168	0.86BDF	0.84	2141	0.82BdF	0.91
o/xo	561	4.93	0.45CEF	0.97	195	0.41CeF	0.88	366	0.47CeF	1.01
Performance test results – Wyniki próby dzielności										
TEP	6291	55.30	0.29ABC	1.13	2475	0.28ABC	1.31	3816	0.30AB	1.00
Han	469	4.12	0.07ADE	1.07	223	0.02ADE	1.24	246	0.12ACD	0.89
xx	3309	29.09	0.48BD	1.16	1168	0.47BDf	1.35	2141	0.49BC	1.04
o/xo	561	4.93	0.49CE	1.09	195	0.68CEf**	1.29	366	0.39D**	0.95

Means in rows (columns: Stallions and Mares): significantly differ at: **P < 0.01 or *P < 0.05. The trait-specific means in columns marked with the same letter differ at (uppercase) P < 0.01 or (lowercase) P < 0.05. TEP – Trakehner/East–Prussian.

Średnie w wierszach (z kolumn: ogiery, klacze) różnią się istotnie przy: ** P < 0,01 lub *P < 0,05. Średnie w kolumnach w obrębie określonej cechy oznaczone tą samą literą różnią się istotnie przy: wielkie litery – P < 0.01; małe litery – P < 0.05. TEP – Koń Trakeński wschodniopruski.

lions and mares, identified for the particular traits of horses belonging to a specific lineage type. Thus, as regards the Trakehner/East-Prussian lineages, the stallions highly significantly surpassed the mares with their breeding value mean levels within the following areas: overall WHo based on the analysed body conformation and performance traits and WHi based on the "bulkiness" and "boniness" indices, comprehensive body conformation assessments and chest circumference indices (significantly). On the other hand, the stallions were highly significantly inferior to the mares in the case of wither height. As regards the other lineage types, statistically significant differences were almost non-existent, apart from the case of the performance test results – actually determined for the stallions and estimated (BLUP method) for the mares – of the horses belonging to the Anglo-Arabian lineages.

DISCUSSION

Obvious issues in breeding organisation include not only the problem of an in-depth analysis of the breeding role of the discussed origin/variety types of lineages but also the individual influence of the progeniture of particular founding sires. For the above reason, further improvement efforts should mainly involve lineages with the greatest positive influence on the development of body conformation and performance traits of Wielkopolski horses. At the same time, the breeding role of the "dominant lineages" should finally receive adequate and ample organisational support.

The findings of the present study suggest that its results should be generally used in Wielkopolski breeding. It should be stipulated, though, that they have greater importance in terms of the protection of the gene pool of the breed, where the maintenance of the existing (best) lineages is the prime task. The determination of the breeding quality of male lineages and female families should follow the rules already proven in the breeding of declining horse varieties (e.g. the Lipizzaner Horse – 26, the Old Kladrub Horse – 6, and the Irish Draught Horse – 22) and those employed in the breeding of Trakehner horses (25), a population that is historically connected with Wielkopolski horses (16). The Trakehner Horse population additionally has a similar – as compared with the present results – origin and breed structure, as its present share of Thoroughbred genes is estimated at 22.3%, whereas the "ox" (i.e. half-blooded Anglo-Arabian in the present study) genes are currently present at a proportion of 11.7% (35).

As regards the improvement of the principal Wielkopolski breed population, it is, in turn, necessary to orient organisational and breeding measures on the creation of local sub-lineages (on the basis of clearly internationally outstanding lines of various half-bred stallions, though – as their present "rigid" breed origin requ-

irements are currently of definitely secondary importance) initiated exclusively by sires producing offspring that meets present horse application requirements. Particular attention should be paid in this case to the use of Hanoverian sires – representing a breed with which the population of Wielkopolski horses is currently evidently strengthening its ties. The Hanoverian breed is currently one of the leading half-blooded horse groups in the breeding and production of high-performing sports horses. In reference to the present study, it seems proper to emphasize the fact that the population of Hanoverian horses was found to have received the influence of various horse breeds in the case of the breeding value of the mares as evidenced in the body conformation traits. The influence was determined at the following levels: the original breed – 0.58, Thoroughbred share – 0.23, Trakehner share – 0.07 and Holstein admixture – 0.05 (29).

In general conclusion, it must be emphasized that there are fundamental (and mostly statistically highly significant) differences between the general breeding value means as calculated on the basis of all the (cumulatively analysed) body conformation and performance traits of the Wielkopolski horses between the main lineage types. They testify to a specific importance of each lineage for breeding. The above findings should form the basis for profound breeding conclusions concerning further maintenance of the lineages that mostly contribute to the improvement of the body conformation and performance traits of Wielkopolski horses.

The maintenance of the already existing particular lineages of Wielkopolski horses is of special importance for the protection of the gene pool of the breed. Any further improvement of the principal active breeding population, on the other hand, chiefly requires the development of new lineages producing horses that meet contemporary utilitarian needs.

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WARTOŚĆ HODOWLANA W ZAKRESIE POKROJOWO-UŻYTKOWYCH CECH KONI WIELKOPOLSKICH, NALEŻĄCYCH DO OKREŚLONYCH RODÓW W OBRĘBIE KOLEJNYCH TOMÓW KSIĘGI STADNEJ

Streszczenie. W badaniach pokrojowo-użytkowych cech 11 376 koni wielkopolskich, umieszczonych w sześciu kolejnych tomach księgi stadnej, wyodrębniono 24 główne rody ogierów (podzielone następnie na 4 typy pochodzeniowe: „trak./wsch.pr.", „han.", „xx" i „o/xo"), do których należało 10 630 koni. Poszczególne typy rodów reprezentowały bardzo zróżnicowaną liczbę należących do nich koni, wykazując przy tym tendencje do stopniowego zaniku (typ – „trak./wsch.pr."), pozostawania w stagnacji („o/xo") lub wyraźnego rozwoju („xx" i „han."). W obrębie średnich wartości wskaźników pokrojowo-użytkowych cech badanych koni ustalono znaczną liczbę statystycznie istotnych różnic (głównie przy $P \leq 0{,}01$) między pochodzeniowymi typami rodów, co wskazuje na ich nader znaczące oddziaływanie hodowlane w kształtowaniu utylitarnej przydatności koni rasy wielkopolskiej. Ponadto wskazano na ewidentną potrzebę kultywowania istniejących rodów w subpopulacji objętej programem ochrony genetycznych zasobów koni wielkopolskich oraz tworzenia nowych linii i rodów – w celu doskonalenia podstawowej populacji omawianej rasy – lecz wyłącznie na bazie ogierów-reproduktorów przekazujących na swoje potomstwo zestawy cech pokrojowo-użytkowych, warunkujących jego wysoką przydatność do sprostania wymaganiom w zakresie różnych kierunków, form oraz sposobów współczesnego użytkowania koni.

Słowa kluczowe: wartość hodowlana, konie wielkopolskie, księgi stadne

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