

RESULTS OF BREEDING USE OF INSEMINATION BOARS OF SELECTED BREEDS IN THE SEASONS OF THE REPRODUCTIVE CYCLE OF THE EUROPEAN WILD BOAR (*SUS SCROFA* L.)

Krzysztof Tereszkiewicz¹✉, Kazimierz Pokrywka²

¹Rzeszow University of Technology, Faculty of Management, Department of Computer Engineering in Management, al. Powstańców Warszawy 10, 35-959 Rzeszów, Poland

²Polish Herbalists and Herb Doctors Association, Stanisław Pigoń State Higher Vocational School, ul. Rynek 1, 38-400 Krosno, Poland

ABSTRACT

The study aimed to investigate changes in semen parameters of insemination boars of selected breeds with reference to seasonal changes in the properties of ejaculates in the European boar (*Sus scrofa* L.). The material for the study covered 88000 ejaculates obtained from boars of the following breeds: Polish Large White, Polish Landrace, Duroc, Hampshire, Pietrain, Duroc×Pietrain, Pietrain×Duroc. The results of the research indicate that seasonal changes in the quality of the produced ejaculates, similar to those occurring in the males of the wild boar, still occur in insemination boars. The observed changes concern above all the volume of the ejaculates, the total number and concentration of spermatozoa. Seasonal variation in the quality of the produced ejaculates is fixed and has not decreased in the recent years despite the conducted breeding activities, selection and the limitation of the influence of environmental factors.

Key words: Boar, breed, atavism, ejaculate, seasonal changes

INTRODUCTION

Boars used for insemination show considerable variation in physical and qualitative properties of ejaculates, which is conditioned by genetic as well as numerous environmental factors. According to authors [Banaszewska et al. 2007, Wilczyńska et al. 2013, Dziekońska et al. 2014, Koprianiuk et al. 2014, Zasiadczyk et al. 2015], the season of semen collection plays a significant role among the environmental factors determining the quality of boars' semen. According to Auvigne et al. [2010] and Górski et al. [2017], seasonal differences in the sexual activity and semen parameters have evolutionary grounds and result from a close affinity of contemporary breeds of pigs to the wild boar (*Sus scrofa* L.). The wild boar, living in its natural habitat in Europe, represents a species characterized by seasonal sexual activity [Kozdrowski and Dubiel 2004b]. The phenomenon of seasonality concerns both males and females. Literature data [Kozdrowski and Dubiel 2004b, Kozdrowski and Dubiel 2004c] in-

dicates that an increase in the sexual activity of boars can be observed in the autumn-winter period. In this period, females show (*oestrus*) symptoms and the peak of the breeding season (*estrus*) takes place in November and December, while the sexual arousal resting period (*anoestrus*) in the summer. In boars, seasonal variation in breeding properties is reflected in a considerably lower volume and concentration of spermatozoa in the semen and in a decrease in sexual activity in the summer. In the autumn-winter period, an increase in the weight of the testicles, in the level of testosterone and in enzyme activity in the semen can be seen [Mauget and Boissin 1987]. The volume and the concentration of spermatozoa in the ejaculates increases as well. Seasonal variation in the properties of the semen have also been observed in hybrids of the wild boar and the domestic pig [Kozdrowski and Dubiel 2004a]. Research [Milewska and Falkowski 2004, Pokrywka et al. 2014, Petrocelli et al. [2015], Szostak and Przykaza 2016] shows that the long-term process of pig domestication did not lead to

a complete elimination of seasonal variation in breeding use and boars' sexual activity. The influence of the season on quantitative and qualitative properties of boars' semen has been confirmed in numerous studies. The effect of the season has been considered in the context of changes in specific months [Adamiak et al. 2010, Wilczyńska et al. 2013, Koprianiuk et al. 2014], seasons [Knecht et al. 2014, Caisin and Snitco 2016, Górski et al. 2017], and photo-periods [Claus and Weiler 1985, Sancho et al. 2004, Rivera et al. 2005, Knecht et al. 2013]. According to Colenbrander and Kemp [1990], seasonal fluctuations in semen production in boars may amount to 25–30%. According to some authors [Knecht et al. 2013], lower results of breeding use of boars observed in the summer may be associated with high temperatures and the heat stress which follows. Kunavongkrit et al. [2005] claim that a high temperature may unfavorably impact the spermatogenesis, leading to the degradation of the seminiferous epithelium of the testicles. These changes lead to the lowering of production and concentration of spermatozoa in the ejaculate. Studies [Brucka-Jastrzębska et al. 2008, Knecht et al. 2013, Pokrywka et al. 2014, Górski et al. 2017] show that seasonal changes in boars' semen properties may vary in different breeds of pigs. Breeds of pigs produced and maintained in the northern hemisphere in the zones further from the equator show a particular susceptibility to seasonal changes in sexual activity [Petrocelli et al. 2015]. Boars of particular breeds or their hybrids may show seasonal differences in the volume of the ejaculate, in the concentration and motility of spermatozoa [Milewska and Falkowski 2004, Brucka-Jastrzębska et al. 2008, Koprianiuk et al. 2014]. The effect of the season on the morphological image of the collected semen, which tends to be worse in the summer and early autumn, Polish Large White was also shown [Smital 2009, Dziekońska et al. 2014, Kamanová et al. 2018]. Studies by Banaszewska et al. [2007] indicate that boars of the PLW and Hampshire breeds are less prone to seasonal variation in the quality of the semen. The semen of the Polish Landrace, Duroc and Pietrain breeds undergoes qualitative changes to a greater extent. The analysis of literature [Mauget and Boissin 1987, Kozdrowski and Dubiel 2004a, Kozdrowski and Dubiel 2004b, Kozdrowski and Dubiel 2004c, Dziekońska et al. 2014] concerning semen quality and breeding activity of boars and males of the wild boar and the domestic pig indicates that June-July months are the period when the quality of the produced ejaculates is the lowest, while the semen obtained in November and December exhibits the most favourable properties.

The aim of the research was to evaluate variation in semen parameters of insemination boars of selected breeds with reference to seasonal changes in the properties of ejaculates observed in the wild boar (*Sus scrofa* L.), considered an ancestor of the domestic pigs used

nowadays. The study also attempted to show tendencies in seasonal variation in semen parameters of the examined boars between 1995 and 2014.

MATERIAL AND METHODS

The material for the study comprised 88,000 ejaculates obtained between 1995 and 2014 from boars of the following breeds: Polish Large White (PLW) – 85, Polish Landrace (PL) – 316, Duroc (D) – 14, Hampshire (H) – 10, Pietrain (P) – 70, Duroc×Pietrain (D×P) – 36, Pietrain×Duroc (P×D) – 35, used in Boars' Exploitation Station in Czermin (GPS 50°20' 32.2'' N, 21°20' 45.1'' E), a branch of the Małopolskie Center of Biotechnology. The animals were kept in accordance with applicable welfare standards included in (WE) Regulation No. 882 [UE 2004]. The boars were kept in closed rooms in separate coops of 6 m² size, inlaid with sawdust. The temperature in the room was maintained between 12°C and 20°C, with relative humidity of 70–75%. The boars were fed individually using a delivery system with complete feed granular mixture for breeding boars, containing on average 12.5 (JM) of metabolic energy and 16.5 g general protein. The feeding of all boars from experiment always meet its requirements on energy and all other nutrients. The animals had constant access to water. Before semen collection, boars were stimulated by a short physical activity involving a walk from the coop to the sampling point. Ejaculates were collected by the manual method described by King and Macpherson [1973]. All the animals had a verified health status. The collected ejaculates underwent laboratory tests: the volume of the semen (ml) was measured directly after the collection by means of a scaled cylinder with the accuracy up to 10ml; the concentration of spermatozoa ($\times 10^6$ ml⁻¹) in the ejaculate was measured by means of the colimetric spectrophotometric method involving a measurement of the intensity of light passing through a suspension of spermatozoa in an isotonic solution of sodium chloride or sodium citrate. On the basis of the semen volume and spermatozoid concentration, the total number of spermatozoa per ejaculate was calculated and expressed as 109 spermatozoa per ejaculate. The percentage of progressively motile spermatozoa (%) was estimated using a microscope in 200-times magnification (Nikon Eclipse E100, Nikon Instruments, Japan). The total number of progressively motile spermatozoa (109) was calculated as the product of the total number of spermatozoa per ejaculate and the percentage of progressively motile spermatozoa. The number of insemination doses (n) was calculated after dividing diluted semen (MERCK III diluent) into insemination doses of 100 ml volume containing 3.0×10^9 spermatozoa. To conduct morphological evaluation, agents coloured by nigrosine and eosin were produced, which were examined under a light microscope, isolating spermatozoa with cor-

rect conformation and those showing major and subordinate changes according to the classification by Blom [1981]. The parameters of the ejaculates of the boars of the examined breeds were analyzed statistically in two collection seasons, i.e. November–December (season A) and July–August (season B).

Statistical analysis was conducted based on arithmetic averages and standard deviations (SD). In order to estimate differences between the averages a single-factor variance analysis for a non-orthogonal system was used, while the significance of the differences was estimated by means of the Tukey test. Statistical inference was conducted at two significance levels $P \leq 0.01$ and $P \leq 0.05$. Additionally, average results of breeding properties of the boars used in the analyzed station between 1995–2004 (I) and 2005–2014 (II) were calculated and summarized in the form of a graph. Statistical analysis was conducted by means of STATISTICA (12.0) software.

RESULTS

Table 1 shows seasonal variation in physical parameters of the semen of the boars of the examined breeds. The obtained results clearly show that the ejaculates obtained from the boars in November–December in comparison with those collected in July–August were characterized by a statistically significantly larger volume. Differences in the volume of the ejaculates between the analyzed seasons were observed in the semen of boars of all the breeds and of hybrids. The greatest difference in the volume of the ejaculate, amounting to 47.60 ml, was stated for the Hampshire breed and for the PLW breed (25.98 ml). It is worth noting that smaller differences in the volume of the ejaculates collected in the analyzed seasons were observed in hybrid boars. It was observed that ejaculates obtained in November–December were characterized by a lower concentration of spermatozoa. This interdependence was statistically confirmed in the semen of the boars of the PLW, PL, Duroc ($P \leq 0.01$) and Hampshire ($P \leq 0.05$) breeds. Despite a lower concentration of spermatozoa in the semen obtained in November–December, their total number in the ejaculates was statistically significantly higher – from 3.80×10^9 (Pietrain \times Duroc) to 5.85×10^9 (Hampshire). As a result of this interdependence, more portions of semen were produced from the ejaculates obtained in this period. The difference in the number of doses ranged between 1.17 for the Pietrain \times Duroc breed to 1.80 for the Hampshire breed. Seasonal variation in the number of semen doses was statistically confirmed ($P \leq 0.01$) with the exception of the Duroc breed. The conducted analysis of qualitative parameters of the semen of the respective boars shows that the largest seasonal differences in the factors determining the breeding efficiency of insemination boars were stated for the Hampshire breed.

Table 2 shows seasonal variation in the morphological parameters of the semen of the examined breeds. A statistically significant influence of the examined factor on the morphological parameters of boars' semen was not observed in the study. The observed seasonal differences in the percentage of spermatozoa with morphological changes did not exceed 2%. It was observed, however, that a higher percentage of spermatozoa with major and subordinate changes occurred in the semen obtained in July–August in all the examined breeds.

Figures 1–5 show differences in physical parameters of the ejaculates of the boars of the examined breeds in the period 1995–2005 and 2006–2014. The presented data indicate that seasonal differences in the quality of the produced ejaculates are fixed and have not diminished despite breeding activities, selection and the limitation of the influence of environmental factors conducted in the recent years. Comparing ten-year periods in the use, it was observed that seasonal differences referring to selected semen properties have even increased. An increase in the differences was stated for the volume of the ejaculate in the PLW, PL and Duroc breeds, and for the spermatozoid concentration factor especially in the PL and Duroc breeds.

DISCUSSION

The breeds of the domestic pig used nowadays belong to polyestral animals. However, as numerous studies show [Smital 2009, Kondracki et al. 2012, Dziekońska et al. 2014], seasonal differences in the sexual activity in boars can still be seen. Seasonal changes are observed in qualitative and quantitative indexes of the semen. The research has shown a significant influence of the season on the volume of the ejaculate, which was by 12.04 ml ($P \times D$) to 47.60 ml (H) higher in November–December, depending on the breed. The obtained results show that seasonal variation in the volume of the ejaculate is similar to that observed in wild boars. As Kozdrowski and Dubiel [2004c] proved, boars produce ejaculates of the greatest volume amounting to 150 ml in November and December, while in the period between May and July, the volume of the ejaculates does not exceed 100 ml. Similar changes in the volume of the ejaculate in the annual cycle were stated for hybrids of wild boar males with the domestic pig [Kozdrowski and Dubiel 2004a]. The obtained results show that the examined boars preserved the propensity to seasonal variation in the volume of the ejaculate, but the differences are not as marked as in their ancestors and do not exceed 10%. A higher volume of the ejaculates in the autumn – winter period was also observed by other authors [Milewska and Falkowski 2004, Adamiak et al. 2010, Brodzki et al. 2015]. According to Wilczyńska et al. [2013], ejaculates of the greatest volume are obtained in December and January. The authors emphasize that

Table 1. Seasonal changes in quantitative parameters of the semen of boars of selected breeds

Tabela 1. Sezonowe zmiany parametrów ilościowych nasienia knurów wybranych ras

Specification Cechy	Season A – Sezon A			Season A – Sezon B			Difference Różnica A – B	
	n	mean	SD	n	mean	SD		
Volume of ejaculates, ml – Objętość ejakulatu, ml								
Breed – Rasa	PLW	1846	266.15 ^A	93.35	1664	240.17 ^B	84.88	25.98
	PL	8202	283.51 ^A	104.98	7719	258.74 ^B	94.58	24.77
	Duroc	221	181.18 ^A	58.41	250	157.76 ^B	53.45	23.42
	Hampshire	274	280.29 ^A	98.38	272	232.69 ^B	88.66	47.60
	Pietrain	1646	265.61 ^A	99.47	1448	244.84 ^B	97.49	20.77
	D×P	1674	239.88 ^A	73.37	1604	222.31 ^B	70.92	17.57
	P×D	1285	241.20 ^A	84.64	1215	229.16 ^B	78.32	12.04
Percentage of progressively motile spermatozoa, % – Odsetek plemników o ruchu postępowym, %								
Breed – Rasa	PLW	1846	68.61	4.35	1664	68.56	4.64	0.05
	PL	8202	67.91 ^a	5.55	7719	67.66 ^b	6.56	0.25
	Duroc	221	67.69	7.36	250	68.00	4.30	-0.31
	Hampshire	274	66.64	5.03	272	66.27	6.31	0.37
	Pietrain	1646	68.32	5.35	1448	68.44	5.32	-0.12
	D×P	1674	69.11 ^A	3.15	1604	68.45 ^B	6.24	0.66
	P×D	1285	69.55	4.46	1215	69.54	3.55	0.01
Concentration of spermatozoa, ×10 ⁶ ml ⁻¹ – Koncentracja plemników, ×10 ⁶ ml ⁻¹								
Breed – Rasa	PLW	1846	432.94 ^A	119.73	1664	458.06 ^B	131.16	-25.12
	PL	8202	426.94 ^A	130.18	7719	441.28 ^B	134.99	-14.34
	Duroc	221	443.95 ^A	120.57	250	470.50 ^B	113.82	-26.55
	Hampshire	274	370.15 ^a	131.09	272	396.05 ^b	137.07	-25.90
	Pietrain	1646	426.14	137.94	1448	422.05	136.11	4.09
	D×P	1674	451.21	131.38	1604	459.89	134.76	-8.68
	P×D	1285	472.19	134.30	1215	466.52	141.10	5.67
Total number of progressive spermatozoa, ×10 ⁹ – Ogólna liczba plemników o ruchu postępowym, ×10 ⁹								
Breed – Rasa	PLW	1804	77.34 ^A	24.95	1629	73.41 ^B	23.68	3.93
	PL	7931	79.20 ^A	26.20	7435	75.35 ^B	22.65	3.85
	Duroc	211	55.98	23.45	239	51.99	20.55	3.99
	Hampshire	262	63.83 ^A	19.13	260	57.98 ^B	17.93	5.85
	Pietrain	1608	74.01 ^A	22.39	1401	68.85 ^B	22.62	5.16
	D×P	1638	73.77 ^A	22.52	1545	69.97 ^B	21.92	3.80
	P×D	1262	76.31 ^A	23.33	1190	72.51 ^B	21.26	3.80
Number of insemination doses, n – Liczba dawek inseminacyjnych, n								
Breed – Rasa	PLW	1804	25.39 ^A	7.79	1629	24.12 ^B	7.35	1.27
	PL	7931	26.20 ^A	7.34	7435	24.94 ^B	7.12	1.26
	Duroc	211	18.24	7.32	239	17.10	6.44	1.14
	Hampshire	262	21.10 ^A	6.17	260	19.30 ^B	5.92	1.80
	Pietrain	1608	24.43 ^A	6.99	1401	22.83 ^B	7.03	1.60
	D×P	1638	24.47 ^A	7.13	1545	23.24 ^B	6.84	1.23
	P×D	1262	25.39 ^A	7.49	1190	24.22 ^B	6.87	1.17

A, B – Differences between average values represented by different letters in the same row ($P \leq 0.01$).

A, B – Średnie w wierszach oznaczone różnymi literami różnią się istotnie przy $P \leq 0,01$.

a, b – Differences between average values represented by different letters in the same row ($P \leq 0.05$).

a, b – Średnie w wierszach oznaczone różnymi literami różnią się istotnie przy $P \leq 0,05$.

Table 2. Seasonal changes in morphological parameters of the semen of boars of selected breeds

Tabela 2. Sezonowe zmiany parametrów morfologicznych nasienia knurów wybranych ras

Specification Cechy		Season A – Sezon A			Season B – Sezon B			Difference Różnica A – B
		n	mean	SD	n	mean	SD	
		The percentage of spermatozoa with major changes, % Odsetek plemników ze zmianami głównymi, %						
Breed – Rasa	PLW	105	1.12	0.31	103	1.78	0.87	–0.66
	PL	352	2.13	1.40	338	3.73	1.83	–1.60
	Duroc	18	2.50	0.91	21	3.15	1.32	–0.65
	Hampshire	23	2.81	1.25	22	2.44	1.78	–0.37
	Pietrain	117	1.17	0.74	106	2.59	1.01	–1.42
	D×P	121	1.51	0.88	119	2.57	1.62	–1.06
	P×D	99	1.68	0.96	95	2.65	1.45	–0.97
		The percentage of spermatozoa with subordinate changes, % Odsetek plemników ze zmianami podrzędnymi, %						
Breed – Rasa	PLW	105	2.01	1.95	103	3.94	1.17	–1.93
	PL	352	3.67	2.30	338	4.09	2.25	–0.42
	Duroc	18	3.98	1.05	21	4.58	1.98	–0.60
	Hampshire	23	3.26	1.48	22	4.18	1.11	–0.92
	Pietrain	117	2.78	1.62	106	4.08	2.08	–1.30
	D×P	121	1.87	1.04	119	3.02	2.07	–1.15
	P×D	99	2.05	1.14	95	3.48	2.15	–1.43

seasonal changes in this parameter are similar in boars of the respective breeds. [Knecht et al. \[2013\]](#) showed a relation between the volume of the ejaculates and the length of the light day, with an increase in the volume of the ejaculate occurring parallel to the shortening of the length of the light day. A similar interdependence was observed by other authors [[Sancho et al. 2004](#), [Petrocelli et al. 2015](#)].

According to the data by [Kozdrowski and Dubiel \[2004a\]](#), the motility of spermatozoa in boars undergoes seasonal variation with a decrease in this index observed in the summer. The lowest values of the index occur in July. In other studies [[Kozdrowski and Dubiel 2004c](#)], the authors observed a lower percentage of progressively motile spermatozoa in August. The research [[Kozdrowski and Dubiel 2004a](#)] conducted on the semen of hybrids of the wild boar and the domestic pig showed that the percentage of motile spermatozoa was lower in the summer months and increased until November, when it was the highest. The available literature [[Adamiak et al. 2010](#), [Koprianiuk et al. 2014](#), [Zasiadczyk et al. 2015](#)] does not clearly point to seasonal variation in the motility of boars' spermatozoa. According to [Smital \[2009\]](#), an increase in the percentage of progressively motile spermatozoa in boars' semen can be observed from October to January.

[Wilczyńska et al. \[2013\]](#), by contrast, claim that seasonal variation in spermatozoa motility is rather small. The present study also shows that the percentage of progressively motile spermatozoa in the analyzed seasons in most of the examined breeds was similar and complied with the current norms [[Brodzki et al. 2015](#)]. A statistically significantly higher percentage of progressively motile spermatozoa in winter was observed only in the PLW breed and Duroc×Pietrain hybrids. Authors [[Kozdrowski and Dubiel 2004a](#), [Kozdrowski and Dubiel 2004c](#)] show a significant seasonal variation in the concentration and the total number of spermatozoa in the semen of boars and males of the hybrid of the wild boar and the domestic pig. The index of the total number of spermatozoa per ejaculate assumes more favourable values in the animals' breeding season (November–December). From January, the total number of spermatozoa in the semen of the boars decreases rapidly [[Kozdrowski and Dubiel 2004c](#)]. As the present results show, the phenomenon of seasonal variation in the index of the total number of spermatozoa per ejaculate still occurs in boars of the breeds of pig used nowadays. It was shown that the semen of all the examined breeds in the November–December season was characterized by a higher total number of spermatozoa,

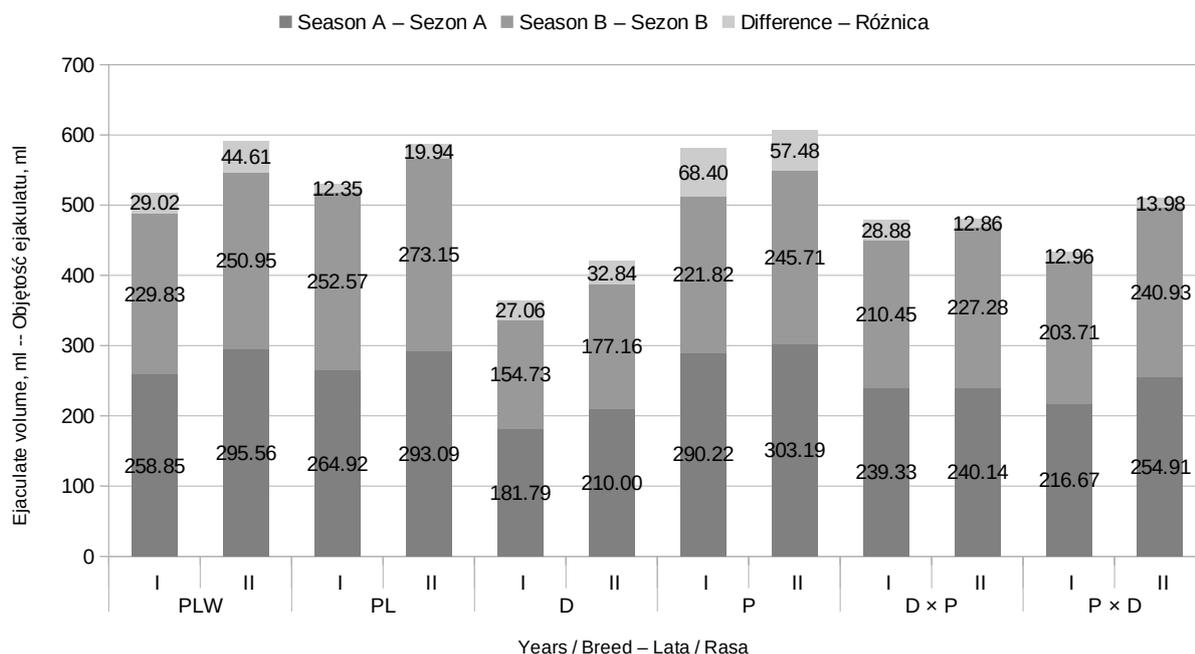


Fig. 1. Seasonal differences in the volume of the ejaculates in boars of the examined breeds in the period 1995–2005 (I) and 2006–2014 (II)

Rys. 1. Sezonowe różnice objętości ejakulatu knurów ocenianych ras w latach 1995–2005 (I) i 2006–2014 (II)

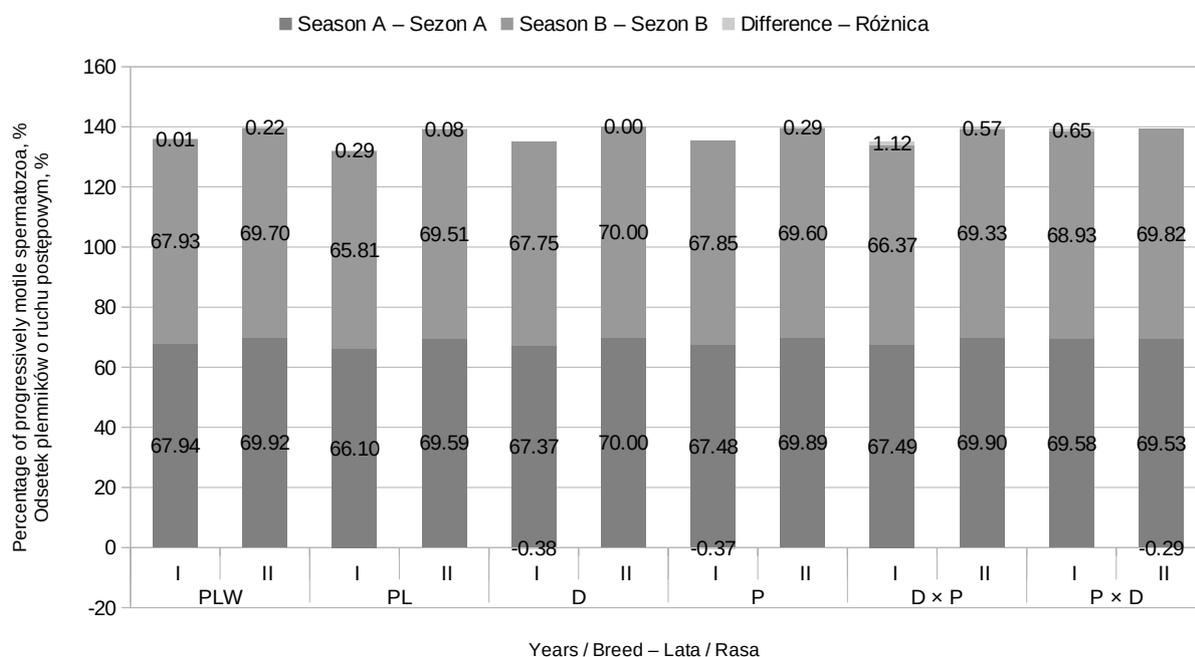


Fig. 2. Seasonal differences in the percentage of progressively motile spermatozoa in boars of the examined breeds in the period 1995–2005 (I) and 2006–2014 (II)

Rys. 2. Sezonowe różnice odsetka plemników o ruchu postępowym knurów ocenianych ras w latach 1995–2005 (I) i 2006–2014 (II)

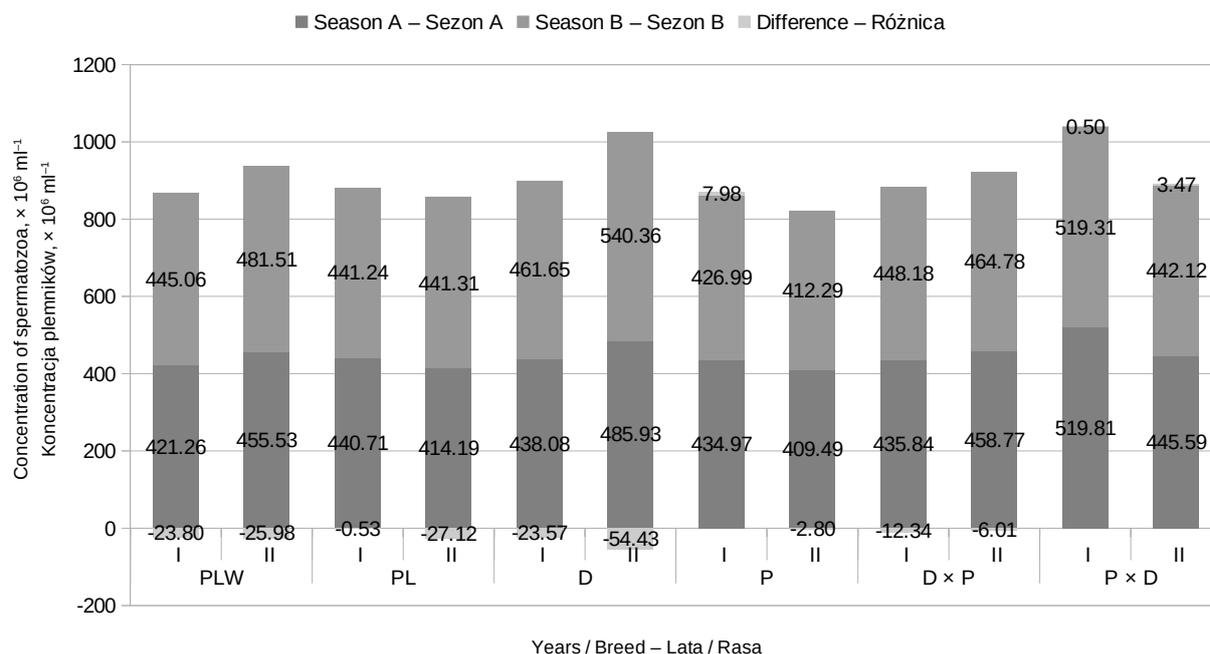


Fig. 3. Seasonal differences in the concentration of spermatozoa in boars of the examined breeds in the period 1995–2005 (I) and 2006–2014 (II)

Rys. 3. Sezonowe różnice koncentracji plemników knurów ocenianych ras w latach 1995–2005 (I) i 2006–2014 (II)

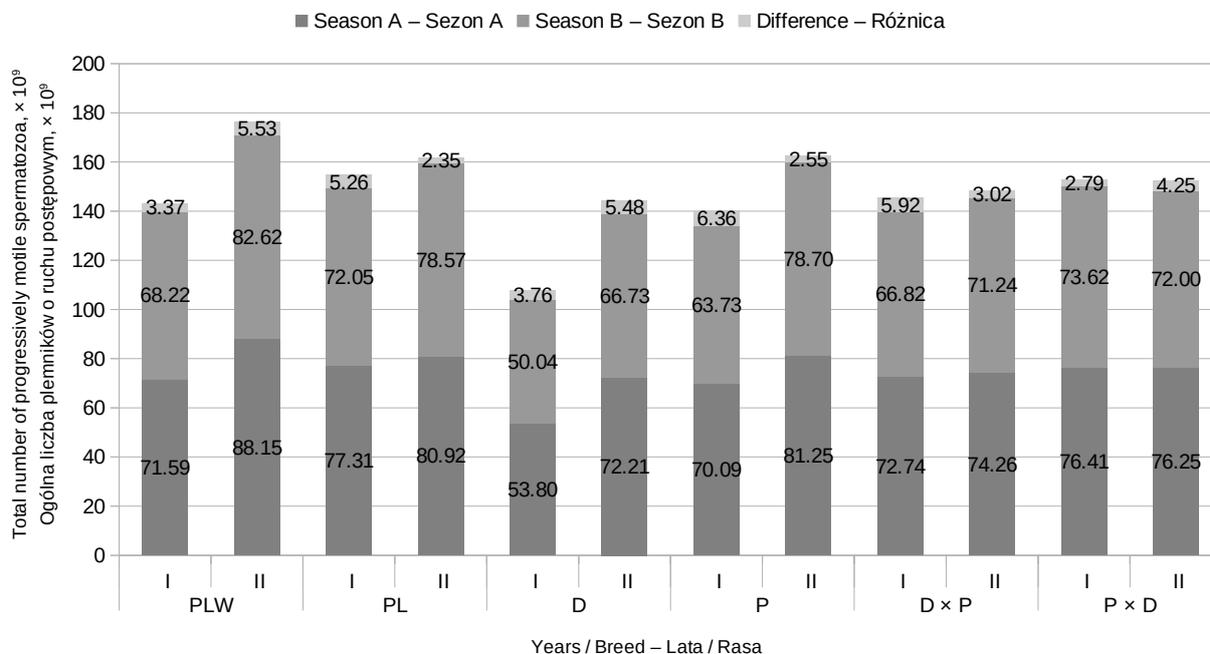


Fig. 4. Seasonal differences in the total number of progressively motile spermatozoa in boars of the examined breeds in the period 1995–2005 (I) and 2006–2014 (II)

Rys. 4. Sezonowe różnice ogólnej liczby plemników o ruchu postępowym knurów ocenianych ras w latach 1995–2005 (I) i 2006–2014 (II)

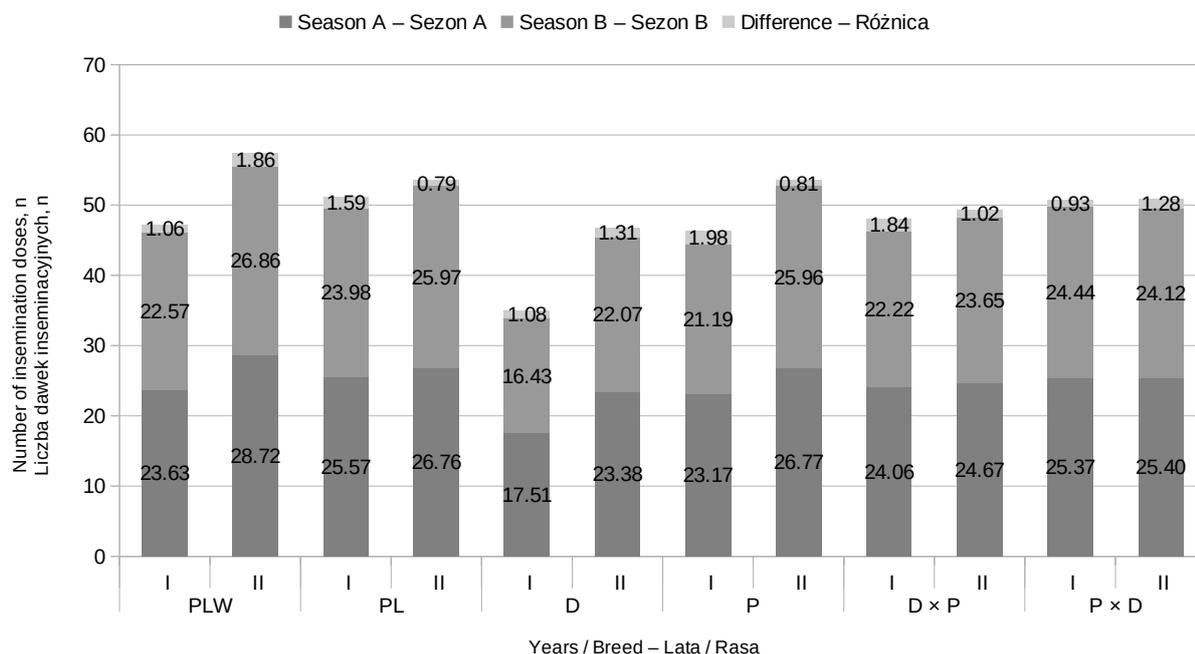


Fig. 5. Seasonal differences in the number of insemination doses of boars of the examined breeds in the period 1995–2005 (I) and 2006–2014 (II)

Rys. 5. Sezonowe różnice liczby dawek inseminacyjnych knurów ocenianych ras w latach 1995–2005 (I) i 2006–2014 (II)

which is in line with data of other authors [Smital 2009, Knecht et al. 2014, Koprianiuk et al. 2014].

The results show that seasonal changes in the index of spermatozoid concentration in currently used breeds of pigs are different from those occurring in the wild boar. It was observed that this index assumed more favourable values in the July–August period for most of the examined breeds. The results are, however, not in line with other sources. According to Knecht et al. [2014] and Górski et al. [2017], a higher concentration of spermatozoa in boars' semen is observed in winter. This observation is confirmed by Petrocelli et al. [2015]. Other studies [Koprianiuk et al. 2014] did not report any differences in the concentration of spermatozoa between November and December, and July and August. The data [Kozdrowski and Dubiel 2004a] show that in the summer period (June–July), the semen of the males of the domestic pig and the wild boar is characterized by a high (amounting to nearly 20%) percentage of spermatozoa with morphological changes. In the following months, the percentage of spermatozoa with incorrect conformation decreases. Seasonal variation in the percentage of spermatozoa showing major and subordinate changes was observed in insemination boars of selected breeds [Banaszewska et al. 2007, Kondracki et al. 2012]. As authors [Brodzki et al. 2015] emphasize, a higher percentage of spermatozoa with morphological changes in

boars' semen obtained in the summer is associated with high temperatures affecting the function of the seminiferous epithelium. The current study did not show significant differences in the morphological parameters of the semen collected in the analyzed seasons.

Seasonal variation in the sexual activity and diversified results of breeding use associated with it may constitute an important problem for a correct organization and planning of semen production in insemination stations, especially if it corresponds to the quality and value of the produced semen doses. As Colenbrander and Kemp [1990] show, the decrease in the number of semen doses produced in the summer months may amount to as much as 30%. Studies by Wilczyńska et al. [2013] show that the most insemination doses were obtained from ejaculates collected in November and December. Also the present research shows that the number of doses obtained from the ejaculates collected from boars of all the examined breeds in November and December was higher. Authors [Milewska and Falkowski 2004, Brucka-Jastrzębska et al. 2008, Caisin and Snitco 2016] note that seasonal variation in the number of produced semen doses depends on the boar's breed. According to Wilczyńska et al. [2013], boars of the Pietrain and Duroc breeds show the highest susceptibility to the influence of the season of the year, visible in the variation in the number of insemination doses. The study shows that nearly four se-

men doses more were produced from the ejaculates collected in December from boars of the Duroc breed in comparison to the number of doses obtained from the ejaculates collected in July and August. Considerable differences in the number of semen doses obtained in these months were also stated for the PL, PLW and hybrids (Duroc×Pietrain) [Knecht et al. 2013]. According to Szostak and Przykaza [2016], nearly six doses of semen less, in contrast to the number of doses obtained from the ejaculates collected in winter, is obtained from the semen collected in the summer from hybrid boars (Pietrain×Duroc). The present study did not find such significant differences in the number of semen doses produced in the analyzed seasons. The greatest difference in the number of the obtained doses (1.80) was stated for boars of the Hampshire and Pietrain breed (1.60). In the case of the PLW and PL, the observed difference was nearly identical and amounted to 1.26 doses.

CONCLUSIONS

The obtained results indicate that seasonal variation in the quality of the produced ejaculates, similar to that of the males of the wild boar, still occurs in boars used for insemination. The observed changes concern above all the volume of the ejaculates, the total number and concentration of spermatozoa, which impacts the number of semen doses. Seasonal differences in the quality of the produced ejaculates in insemination boars of the examined breeds are fixed and have not decreased despite the breeding activity, selection and the limitation of the influence of environmental factors conducted in the recent years.

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WYNIKI UŻYTKOWANIA ROZPŁODOWEGO KNURÓW INSEMINACYJNYCH WYBRANYCH RAS W SEZONACH CYKLU ROZRODCZEGO DZIKA EUROPEJSKIEGO (*SUS SCROFA* L.)

STRESZCZENIE

Celem badań było określenie zmian parametrów nasienia knurów inseminacyjnych wybranych ras w odniesieniu do sezonowych zmian cech ejakulatów występujących u dzika europejskiego (*Sus scrofa* L.). Materiał do badań stanowiło 88000 ejakulatów pozyskanych od knurów ras: Polish Large White, Polish Landrace, Duroc, Hampshire, Pietrain, Duroc × Pietrain, Pietrain × Duroc. Wyniki badań upoważniają do stwierdzenia, że u knurów użytkowanych inseminacyjnie nadal występują sezonowe zmiany jakości produkowanych ejakulatów o przebiegu zbliżonym do samców dzika. Stwierdzone zmiany dotyczą przede wszystkim objętości ejakulatów, ogólnej liczby i koncentracji plemników. Wykazane różnice przekładają się na liczbę dawek nasienia. Sezonowe różnice jakości produkowanych ejakulatów są utrwalone i pomimo prowadzonej pracy hodowlanej, selekcji i ograniczania wpływu czynników środowiskowych w ostatnich latach nie uległy zmniejszeniu.

Słowa kluczowe: knury, rasa, atawizm, ejakulat, zmiany sezonowe