

## COMPARISON OF GROWTH RATE AND BODY WEIGHT OF DUCKS OF DIFFERENT ORIGINS

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**Abstract.** The aim of the study was to compare growth rate and body weight of Pekin and Muscovy ducks and their hybrids (mulards). It was established that up to week 6 of life inclusive, Pekin ducks weighed more compared to Muscovy ducks and mulards, differences were confirmed statistically. From week 1 to 7 of life, mulards had significantly lowest body weight compared to ducks from other two groups. Pekin ducks showed significantly highest body weight gain between weeks 3 and 4 of life, and for Muscovy ducks of both sexes it was between weeks 4 and 5 of breeding. On the other hand, for mulards the highest gains of body weight was observed between weeks 5 and 6 of life. In all groups of ducks the highest growth rate was noted between weeks 1 and 2 (from 100 to 119%). After week 3 of life, intensity of Pekin ducks' growth decreased from 38 to 9% between weeks 7 and 8, for Muscovy drakes from 43 to 2% between weeks 11 and 12, for Muscovy ducks from 46 to 3% between weeks 9 and 10 and for mulard ducks from 46 to 5% between weeks 9 and 10 of life.

**Key words:** Pekin duck, Muscovy duck, mulards, body weight, growth rate

### INTRODUCTION

Due to high growth rate and carcasses containing to great extent of tasty meat, ducks are an ideal species for meat use. In the total production of poultry in the world, ducks represent 5.0%; in the European Union – around 8.0%. In Poland, annual production of duck meat is around 5 tones, and its share in the total production of poultry meat is below 1% [AVEC 2014, Murawska 2010, Biesiada-Drzazga

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2011, 2012]. Domestic production of Pekin ducks is based on genetic improvements of particular strains which are used for crossbreeding between strains in order to obtain mulards characterized by improved production traits. Due to mean or high coefficients of heritability of meat traits, more effective results are obtained in improving these traits rather than reproductive traits. Taking into consideration rather high initial growth rate of ducks, body weight of birds aged 3 and 7 weeks and share of breast and leg muscles, as well as feed intake, are considered in selection [Mazanowski 1994b, 2001]. Different authors [Wężyk and Rosiński 1996, Mazanowski et al. 1999b, Adamski 2003, 2004] noticed that excessive selection for increasing body weight may cause higher fatness of birds related to positive and high correlation between these traits. Modifying meat traits of Pekin ducks through selection was a subject of studies conducted by many authors [Pingel 1990, Korytkowska and Bernacki 1993, Cheng et al. 1996, Mazanowski et al. 1999a, Adamski 2003, Mazanowski et al. 2003].

Muscovy ducks are very popular in farms due to very good adaptation to rearing conditions. They are used in many European countries and are characterized by lower fatness and higher meatiness than Pekin ducks [Pikul et al. 1987, Pingel 1987, Ricard et al. 1988, Bazea et al. 1998, Górski and Witak 2003]. Sexual dimorphism in terms of body weight is highly indicated for this breed. Hybrids of Muscovy and Pekin ducks – mulards – are characterized by good meatiness and low fatness of carcasses. For these ducks, sexual dimorphism is not highly indicated in terms of body weight. Their carcasses are characterized by high share of breast and leg muscles and low share of subcutaneous fat. They are more resistant to environment conditions and breeding temperature than Muscovy ducks [Mazanowski 1995].

In rough hypothesis the assumption was that ducks of different origins are characterized by different growth rates which can determine optimal time for terminating breeding. The aim of undertaken studies was a comparative analysis of gain and the rate of body weight growth of ducks of different origins in subsequent weeks of rearing.

## MATERIAL AND METHODS

The study was conducted on a private farm situated in Kuyavian-Pomeranian voivodeship in Włocławek county, in Sułkówiek. 120 ducks were used in the experiment; they were individually marked and divided into 3 groups – 40 ducks in each, depending on their origin: I – Pekin ducks (STAR 53 HY), II – Muscovy ducks (DROP) and III – mulards (STE-MULARD). All chicks were purchased in Zakład Wylęgu Drobiu (Poultry Hatchery) in Tulce belonging to Wielkopolska Spółka Drobiarska “DROB” SA. In all groups, throughout the experiment, no de-

aths were observed. Ducks were kept in a room with bedding without access to poultry yard with stocking density per 1 m<sup>2</sup>: 8 individuals for the first 3 weeks; afterwards, stocking density was decreased down to 4 individuals per 1 m<sup>2</sup> of floor which is the stocking density recommended for this type of birds [Mazanowski 1995, 2001]. All groups were fed ad libitum with granular all-mash recommended for ducks, consisting of 18% of crude protein and 11.8 MJ of metabolic energy per 1 kg of feed. Birds had constant access to water. In order to show genetic potential of ducks in terms of growth rate, all evaluated ducks were fed with identically balanced feed mixtures. Ducks feeding was conducted according to nourishment recommendations for this type of birds [Smulikowska and Rutkowski 2005].

Ducks were weighed individually every week until the end of breeding. Growth rate was calculated according to the equation:

$$T_w = \frac{(m_k - m_p)}{0.5(m_p + m_k)} \times 100$$

where:

$T_w$  – growth rate,

$m_k$  – body weight at the end of the studied period,

$m_p$  – body weight at the beginning of the studied period.

Collected data were statistically formulated using STATISTICA PL [2002] software. Mean values ( $\bar{x}$ ) of particular traits and their standard error of the mean (SEM) were calculated. Values of analyzed traits were subjected to analysis of variance and evaluation of significance of differences using Scheffé's test.

## RESULTS AND DISCUSSION

Body weight of Pekin ducks during breeding was from 241 g in week 1 to 3401 g in week 8 of breeding (Table 1). Until week 6 of life inclusive, Pekin ducks weighed more compared to Muscovy ducks and mulards; the differences were statistically confirmed. Body weight of Pekin ducks aged 7 weeks and same age mulards did not differ significantly and was 3102 and 2971 g respectively. The lowest body weight at the age of 7 weeks was observed for Muscovy ducks – 2829 g; this value did not differ significantly compared to the one noted for hybrids ♂ Muscovy × ♀ Pekin.

Bernacki et al. [2008], who compared meat traits of foreign (Star 63) and domestic (PP54) Pekin ducks with hybrids ♂ Muscovy × ♀ Pekin observed similar body weight at the age of 7 weeks for Star 63 ducks and lower compared to own studies for PP54. Authors also evaluated the influence of ducks origin on body weight for older birds, since Star 63 ducks showed significantly higher body weight at week 7 of breeding compared to domestic PP54 hybrids. Biesiada-Drzazga

Table 1. Mean values ( $\bar{x}$ ) and standard error of the mean (SEM) of duck body weight over rearing periodTabela 1. Wartości średnie ( $\bar{x}$ ) i średnie błędy standardowe (SEM) masy ciała kaczek w okresie odchowu

Group Grupa	Sex Płeć	Body weight, g – weeks of rearing Masa ciała, g – tygodnie odchowu													
		1 day 1 dzień	1	2	3	4	5	6	7	8	9	10	11	12	
I	♂♀	$\bar{x}$	54.0	241 <sup>a</sup>	720 <sup>a</sup>	1241 <sup>a</sup>	1832 <sup>a</sup>	2395 <sup>a</sup>	2885 <sup>a</sup>	3102 <sup>a</sup>	3401	–	–	–	–
		SEM	0.003	1.1	1.7	4.8	8.1	11.5	12.4	21	15.8	–	–	–	–
II	♂	$\bar{x}$	–	110	421	812	1255	2178	2960	3482	3998	4405	4755	4911	5000
		SEM	–	0.5	0.5	2.0	2.5	4.1	6.6	8.1	12.5	10.5	9.8	8.0	9.7
II	♀	$\bar{x}$	–	102	411	751	1198	1660	1927	2176	2495	2589	2657	–	–
		SEM	–	0.6	1.5	1.5	4.1	7.8	10.4	12.3	14.6	15.4	16	–	–
III	♂♀	$\bar{x}$	54.0	106 <sup>a*</sup>	416 <sup>c*</sup>	781 <sup>c*</sup>	1226 <sup>c*</sup>	1919 <sup>b*</sup>	2443 <sup>b*</sup>	2829 <sup>b*</sup>	3246 <sup>*</sup>	3497 <sup>*</sup>	3706 <sup>*</sup>	–	–
		SEM	0.003	0.6	1	4.1	4.4	34	67.5	85.3	98.3	118.5	136.9	–	–
III	♂♀	$\bar{x}$	45.0	140 <sup>b</sup>	434 <sup>b</sup>	824 <sup>b</sup>	1321 <sup>b</sup>	1870 <sup>b</sup>	2525 <sup>b</sup>	2971 <sup>ab</sup>	3398	3714	3909	–	–
		SEM	0,002	0.5	0.4	2.9	5.3	6.8	5.5	5.3	5.5	4.8	7.8	–	–

Explanations: group I – Pekin ducks, group II – Muscovy ducks, group III – mulards; <sup>a, b, c</sup> mean values of traits in columns with different letters differ significantly between groups ( $P \leq 0.05$ ); \*mean values differ significantly within sexes ( $P \leq 0.05$ ).

Objaśnienia: grupa I – kaczki pekin, grupa II – kaczki piżmowe, grupa III – mulardy; <sup>a, b, c</sup> wartości średnie cech w kolumnach oznaczone różnymi literami różnią się istotnie między grupami ( $P \leq 0,05$ ); \*wartości średnie różnią się istotnie w obrębie płci ( $P \leq 0,05$ ).

[2011] observed lower by 400 g body weight of Star 53 HY Pekin ducks compared to own study. However, Pingel [1999], Farhat and Chavez [2000], as well as Kokoszyński [2009], noted significantly higher body weight in their studies for Pekin mulard hybrid ducks at the age of 7 weeks. Similar to own studies body weight of ducks aged 8 weeks fed with a ration consisting of 25% of dried distillers grains with solubles (DDGS) was observed by Łukaszewicz et al. [2011].

Body weight of Muscovy drakes in 12-week rearing period was from 110 (week 1) to 5000 g at the end of rearing; for ducks in 10-week rearing period it was from 102 (week 1) to 2657 g at the end of rearing. From week 1 of rearing until the end, statistically confirmed sexual dimorphism was noted in terms of body weight. In the analyzed period, mulard ducks weighed from 140 (week 1) to 3909 g (week 10). Over the period from week 1 to 7 of life, mulards had lowest body weight (significant differences) compared to ducks from the other two groups (Table 1).

The lowest body weight, compared to own studies, for drakes and ducks at the age of 4, 7 and 10 weeks was observed by Popescu and Roibu [2001] both for birds fed with diet of high metabolic energy (from 12.33 to 12.78 MJ), as well as for those fed with diet of mean values (11.54 MJ EM). Higher body weight at week 2 and 4 of life was noted for Muscovy ducks in an experiment conducted by Kleczek et al. [2007], where they analyzed the influence of body weight of on-day-old chicks on ducks growth and their slaughter traits. Studies conducted by Górski and Witak [2003] show that development of body weight of Muscovy ducks is

to a greater extent related to feeding rather than to color type. The authors also observed significant differences in body weight of ducks aged 10 weeks both for white and black and white ducks fed with a mash of greater share of crude protein and metabolic energy than those fed with a mash poorer in nutrients. Muscovy ducks aged 2, 4, 6, 8 and 10 weeks of both color types, fed with mashes of higher and lower concentration of nutrients, weighed less than birds same age from own studies. However, lower final body weight of Muscovy drakes (4.5 kg) as well as ducks (2.5 kg) were noted by Pingel [1999] who evaluated influence of genotypes and breeding conditions on ducks production effectiveness.

Pekin ducks were characterized by higher body weight gains between weeks 3 and 4 of life – 591 g (Table 2). Higher body weight growths were also noted between weeks 1 and 2 as well as between weeks 2 and 3 of life. Intensity of Pekin ducks body weight growth in these period was significantly higher than for Muscovy ducks and mulards. The highest gains of Muscovy ducks' body weight was noted between weeks 4 and 5 of rearing (693 g) and it was a value significantly higher than for Pekin ducks and mulards in the same period. However, Muscovy ducks were characterized by higher gains for females throughout the whole rearing period except for between weeks 3 and 4, where body weight gains were similar for males and females. For mulard ducks highest body weight gains were noted between weeks 5 and 6 of life (655 g) and it was a value higher compared to Pekin and Muscovy ducks. Starting from weeks 5 to 6 until weeks 7 to 8, mulards were characterized by higher body weight gains (significant differences) than Pekin ducks. Same was applicable if Muscovy ducks concerned, since mulards surpassed them in terms of weekly body weight gains from weeks 5 to 6 until weeks 8 to 9 of life; it was also proved statistically (Table 2).

Table 2. Body weight gain over duck rearing period

Tabela 2. Przyrosty masy ciała kaczek w okresie odchowu

Group Grupa	Sex Płeć	Body weight gain, g – weeks of rearing															
		Przyrosty masy ciała, g – tygodnie odchowu															
		1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	1-8	1-10	1-12		
I	♂♀	$\bar{x}$	479 <sup>a</sup>	521 <sup>a</sup>	591 <sup>a</sup>	563 <sup>b</sup>	490 <sup>b</sup>	216 <sup>c</sup>	299 <sup>b</sup>	–	–	–	–	–	3347	–	–
	SEM	1.7	4.3	5.5	5.5	5.1	10.9	10	–	–	–	–	–	–	15.8	–	–
II	♂	$\bar{x}$	311	391	442	923	782	522	516	407	350	156	89.4	–	–	4946	–
		SEM	0.6	2.0	2.2	3.4	4.7	5.9	10.1	13.8	9.6	5.4	5	–	–	9.7	–
	♀	$\bar{x}$	309	340	446	462	267	249	319	94	68	–	–	–	–	2603	–
		SEM	1.0	1.9	4.1	6.6	5.5	4.2	3.9	4.3	2.5	–	–	–	–	16.0	–
♂♀	$\bar{x}$	310 <sup>b</sup>	366 <sup>a*</sup>	445 <sup>c</sup>	693 <sup>a*</sup>	524 <sup>b*</sup>	386 <sup>b*</sup>	417 <sup>a*</sup>	251 <sup>b*</sup>	209 <sup>*</sup>	–	–	–	–	3774	–	
	SEM	0.6	3.6	2.3	30.2	33.7	18.1	14	21.6	19.0	–	–	–	–	152.8	–	
III	♂♀	$\bar{x}$	294 <sup>c</sup>	390 <sup>b</sup>	497 <sup>b</sup>	549 <sup>b</sup>	655 <sup>a</sup>	446 <sup>a</sup>	426 <sup>a</sup>	316 <sup>a</sup>	195	–	–	–	–	3864	–
		SEM	0.5	2.8	3.1	5.4	4.6	3.5	3.5	3.1	4.8	–	–	–	–	7.8	–

For explanations see Table 1.  
Objaśnienia jak w tabeli 1.

Popescu and Roibu [2001] as well as Laila Abd El-Samee et al. [2012] analyzed daily gains of Muscovy ducks fed in a diverse way or of different origins. They showed that, as well as in own study, drakes were characterized by higher gains of body weight. The highest mean daily growth of body weight (from 34.92 to 37.55 g) for birds of both sexes, cited authors observed in a period between weeks 4 and 7 of life. Mean daily body weight gains for Muscovy drakes and ducks in total were similar between weeks 1 and 10 and were from 32.09 to 32.2 g. If calculated onto weekly gains, it was a value lower than the one observed in own study. Laila Abd El-Samee et al. [2012] noted however, that the highest gains of body weight (881.67 g) for Muscovy duck is between weeks 3 and 6 of life, similar to the periods from own studies (weeks 4–5).

Ducks from all groups grew most intensively between weeks 1 and 2 of life; the growth rate was from 100% (Pekin) to 119% (Muscovy). The highest and most significant values of body weight growth indices for Muscovy ducks of both sexes were observed in such periods of rearing: weeks 1–2, 2–3, 4–5 and 7–8 of life; indices of growth rates between weeks 2 and 3 as well as 7 and 8 did not differ significantly from those noted for mulards. Muscovy drakes in majority of periods grew faster than females, except for periods between weeks 1 and 2 as well as 3 and 4 where value of growth rate index was higher for females and in a period between weeks 7 and 8, where they had the same values both for males and females. However, mulards surpassed birds from other groups in the intensity of growth rate between weeks 3–4, 5–6, 6–7 and 8–9 of rearing.

After week 3 of life ducks body weight growth rate decreased for all groups. Intensity of growth for Pekin ducks lowered from 38 to 9% in weeks 7–8 of life, for Muscovy ducks from 46 to 3% in weeks 9–10 of life and for hybrids from 46 to 5% in weeks 9–10 of life (Table 3).

Table 3. Growth rate of ducks during breeding period

Tabela 3. Tempo wzrostu kaczek w okresie odchowu

Group Grupa	Sex Płeć	Growth rate, % – weeks of rearing Tempo wzrostu, % – tygodnie odchowu														
		1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	9–10	10–11	11–12	1–8	1–10	1–12	
I	♂♀	$\bar{x}$ 100 <sup>c</sup>	53 <sup>b</sup>	38 <sup>c</sup>	27 <sup>c</sup>	19 <sup>c</sup>	7 <sup>c</sup>	9 <sup>b</sup>	–	–	–	–	–	194	–	–
		SEM 0.3	0.3	0.3	0.2	0.2	0.3	0.3	–	–	–	–	–	0.03	–	–
II	♂	$\bar{x}$ 117	63	43	54	30	16	14	10	8	3	2	–	–	196	–
		SEM 0.3	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.1	0.1	–	–	0.008	–
II	♀	$\bar{x}$ 120	59	46	32	15	12	14	4	3	–	–	–	192	–	–
		SEM 0.2	0.3	0.4	0.4	0.3	0.2	0.1	0.2	0.1	–	–	–	0.04	–	–
II	♂♀	$\bar{x}$ 119 <sup>a*</sup>	61 <sup>a*</sup>	44 <sup>b*</sup>	43 <sup>a*</sup>	23 <sup>b*</sup>	14 <sup>b*</sup>	14 <sup>a</sup>	7 <sup>b*</sup>	5 <sup>*</sup>	–	–	–	194 <sup>*</sup>	–	–
		SEM 0.3	0.4	0.3	1.4	1	0.3	0.1	0.4	0.3	–	–	–	0.2	–	–
III	♂♀	$\bar{x}$ 102 <sup>b</sup>	62 <sup>a</sup>	46 <sup>a</sup>	34 <sup>b</sup>	30 <sup>a</sup>	16 <sup>a</sup>	13 <sup>a</sup>	9 <sup>a</sup>	5	–	–	–	195	–	–
		SEM 0.2	0.3	0.2	0.3	0.2	0.1	0.1	0.1	0.1	–	–	–	0.008	–	–

For explanations see Table 1.

Objaśnienia jak w tabeli 1.

Comparing meat traits of foreign Star 63 Pekin ducks aged 7 weeks compared to Polish PP54, Bernacki et al. [2008] noted the highest growth rates for birds aged 3 weeks (183%). Cited authors observed lower intensity of growth rate from week 4, similarly as for ducks in own studies. Łukaszewicz et al. [2011] showed that different addition of dried distillers grains with solubles (DDGS) had a positive influence of development of growth rate expressed in percentage for Pekin duck females in all evaluated rearing periods (i.e. weeks 1–3, 3–7 and 7–8); for drakes, however, it was only noticed between weeks 3 and 7 of life. In the cited studies, as well as in own studies, the highest intensity was noted on week 3 of life.

## CONCLUSIONS

Until week 6 of life inclusive, Pekin ducks had the highest body weight compared to Muscovy ( $\sigma + \varphi$ ) and mulards; differences were statistically confirmed. In the period between weeks 1 and 7 of life, mulards were characterized by significantly lowest body weight compared to ducks from the other two groups. For Muscovy ducks, starting from week 1 of rearing until its termination, highly indicated sexual dimorphism was noted in terms of body weight (differences statistically confirmed). In the majority of rearing periods Muscovy ducks were characterized by significantly higher body weight gains. Pekin ducks showed significantly higher body weight growths between weeks 3 and 4 of life and Muscovy ducks of both sexes between week 4 and 5 of rearing. However, for mulards the highest gains of body weight were observed between weeks 5 and 6 of life. After week 3 of life, intensity of body weight growth of ducks from all groups was decreasing.

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## PORÓWNANIE TEMPA WZROSTU I MASY CIAŁA KACZEK O RÓŻNYM POCHODZENIU

**Streszczenie.** Celem badań było porównanie tempa wzrostu i masy ciała kaczek pekin, piżmowych oraz ich mieszańców (mulardów). Stwierdzono, że do 6. tygodnia życia łącznie kaczki pekin ważyły więcej w porównaniu z kaczkami piżmowymi oraz mulardami i były to różnice potwierdzone statystycznie. W okresie od 1. do 7. tygodnia życia mulardy odznaczała istotnie najmniejsza masa ciała w porównaniu z kaczkami z pozostałych dwóch grup. Kaczki pekin wykazywały istotnie największe przyrosty masy ciała między 3. a 4. tygodniem życia, a kaczki piżmowe obojga płci między 4. a 5. tygodniem odchowu. Z kolei u kaczek mulardów zaobserwowano największe przyrosty masy ciała między 5. a 6. tygodniem życia. We wszystkich grupach kaczek największe tempo wzrostu odnotowano między 1. a 2. tygodniem życia (od 100 do 119%). Po 3. tygodniu życia intensywność wzrostu kaczek pekin zmniejszyła się z 38% do 9% w 7. i 8. tygodniu, u kaczorów piżmowych z 43% do 2% w 11. i 12. tygodniu, u kaczek piżmowych z 46% do 3% w 9. i 10. tygodniu, a u kaczek mieszańców z 46% do 5% w 9. i 10. tygodniu życia.

**Słowa kluczowe:** kaczka pekin, kaczka piżmowa, mulardy, masa ciała, tempo wzrostu

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