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# ANALYSIS OF REPRODUCTION AND GROWTH IN FANCY PIGEONS

Danuta Majewska✉, Tomasz Drenikowski

Department of Poultry and Ornamental Birds Breeding, West Pomeranian University of Technology, Szczecin, Doktora Judyma 20, 71-466 Szczecin, Poland

**Abstract.** The study was conducted on ornamental pigeons kept by a private pigeon breeder in Poland. The experimental population was Polish Owl and Warsaw Butterfly Tumbler pigeons and the offspring obtained from pairs of these breeds during the breeding season. In the breeding season, the number of eggs laid by each female was recorded, egg weight measurements were made and egg width (short axis) and length (long axis) were measured. The percentage of fertilized eggs and dead embryos, as well as hatchability of set and fertilized eggs were calculated. The body weight was monitored until 3 months of age in order to determine the growth rate. In the breeding season analyzed, Warsaw Butterfly Tumbler pigeons were characterized by better egg laying performance (10.3 eggs per female) than Polish Owl ones (6.72 eggs per female). Both pigeon breeds laid eggs of a similar weight (14.8 g). Egg shape index in Polish Owl pigeons was 73.04%, whereas in Warsaw Butterfly Tumblers it was 3% greater (differences statistically significant). Egg fertilization rate in Polish Owl pigeons was low, 64.86%, whereas in Warsaw Butterfly Tumbler it was 25% higher. Chicks hatched from 97.2% of fertilized eggs in Polish Owl pigeons and from 69.57% eggs in Warsaw Butterfly Tumblers. The highest body weight gains in the pigeon breeds under analysis were observed during the period from hatching to 4 weeks of age.

**Key words:** Polish Owl pigeon, Warsaw Butterfly Tumbler, hatchability, body weight, growth rate

## INTRODUCTION

Pigeons have been with mankind for 5000 years. Information on their domestication can be found in the earliest written documents and on ancient images.

✉danuta.majewska@zut.edu.pl

Initially pigeons were kept for religious cult purposes, only later man began to be used the birds as messengers. Currently homing pigeons are mainly used in racing competitions, which began over 100 years ago in Belgium. Europe remains the world center of pigeon racing, which is extremely popular not only in Belgium, but also in the Netherlands, England, Germany and Poland. Pigeon racing enthusiasts are also numerous in China, Japan, Thailand, and South Africa.

Homing pigeons are just one of 10 groups of pigeons bred in Poland. Fancy pigeons, which are bred for ornamental traits like outstanding plumage shape and color and body structure, are also very popular in our country. Pigeon fanciers aim to develop excellent exhibition birds.

Among some 950 world-known pigeon breeds, more than 350 are bred in Poland [Pawlina and Borys 2011]. More then 50 pigeon breeds originate from Poland, of which many different varieties represent a wide selection of colors and markings. The breeds developed originally in Poland include: Polish Owl, Warsaw Butterfly Tumbler, Polish Krymka Tumbler, Polish Beauty Homer, Polish Wattle Pigeon, Polish Long-Faced Tumbler, Polish Crest Tumbler, Bialostocka Krymka Tumbler, Polish short beak Tumbler, Polish Masciuch Tumbler, Polish Shield Highflyer and Polish shortbeaked Magpie Tumbler. It is alarming that many of the native pigeon breeds are endangered with extinction.

The literature of the subject lacks scientific data or information on fancy pigeons utilization. Most reports [Szmańko et al. 2001, Zieleziński and Pawlina 2007, Pawlina and Borys 2009] are analyses of fertility, growth rate, and slaughter performance of meat pigeon breeds. Bearing this in mind, we have undertaken studies aimed to evaluate the reproduction performance in short-beak Polish Owl and Warsaw Butterfly Tumbler pigeons. We have also analyzed the growth of the chicks until 3 months of age.

## MATERIAL AND METHODS

The studies were carried out on fancy Polish Owl and Warsaw Butterfly Tumbler pigeons bred by a private pigeon breeder in Poland.

The studied population comprised 10 parent pairs of Polish Owl and 3 pairs of Warsaw Butterfly Tumbler pigeons, as well as their offspring born during a breeding season. Since short-beak pigeons are unable to feed their chicks, the breeder must have long-beak pigeons which, as foster parents, will incubate the eggs and rear the chicks of the short-beak pigeon pairs. In our study, the foster parents were Polish Murzyn and Clean-Head White Tail pigeons. During the breeding season, i.e. from March till September, the parent pairs were kept in the breeding loft, whereas the foster parents were kept in the rearing lot.

Over the entire period of the studies, the pigeons were fed a feed of the same composition. The feed was a mixture of fine seeds (Kampol) with and addition of wheat in the proportion 1 : 3.

Additionally, the feed was enriched with powdered vegetables, oregano and liquid additives, i.e. garlic-onion oil, anise oil or natural yogurt. The birds had a constant and unlimited access to water, grit with crushed shells and clay. Water was supplemented with vitamins and electrolytes, as well as bee glue, coneflower extract, buckwheat honey, apple vinegar, herbal infusion and aqueous extract of garlic.

During the reproduction period, the numbers of eggs laid be each female in individual portions were recorded, which enabled us to determine the length of the breeding season. The weight of eggs, as well as the width (short axis) and length (long axis) of each egg were measured. The ratio of width to length (as a percentage) represented the egg shape index.

Each laid egg was immediately marked with a number and given to the foster hen. During the incubation, the eggs were candled, in order to remove infertile or containing dead embryos, and weighed on day 18, in order to calculate weight loss.

We also recorded the weight of day-old chicks in order to determine the percentage of its weight in the total egg mass. On hatching, we also counted the number of healthy, crippled, and weak hatchlings. The percentage of fertilized eggs, dead embryos, and hatchability of chicks was calculated in relation to set and fertilized eggs. Also the body weight of the pigeons was monitored on days 3, 7, 14, 21 and 28 as well as in the 2nd and 3rd month of age, in order to determine their growth rate, which was calculated according to the following formula:

The resulting data were processed using the Statistica 7.1. Pl package. The statistical analysis involved one-way ANOVA, and the significance of differences was tested with the Duncan test.

## RESULTS

Table 1 presents the results of reproductive performance of the pigeons over the analyzed breeding season. The pigeons of both breeds began their breeding season in the last days of March and finished it in the beginning of August. Consequently, the reproductive season lasted 131–132 days.

During the breeding season, the females of Warsaw Butterfly Tumbler and Polish Owl laid one or two eggs at a time (Table 1). The number of lays per one hen ranged from 3.9 (Polish Owl) to 5.3 (Warsaw Butterfly Tumbler). In our study, Warsaw Butterfly Tumblers demonstrated a better laying performance (10.3 eggs per female) compared to Polish Owls (6.72 eggs per female).

Table 1. Reproductive performance of pigeon during the breeding season

Tabela 1. Użytkowość reprodukcyjna gołębi podczas sezonu rozpłodowego

| Item – Wyszczególnienie | Polish Owl<br>Mewka polska | Warsaw Butterfly<br>Motyl warszawski |
|---|---|---|
| Beginning of laying season* – Początek sezonu reprodukcji * | 27.03.2014 | 23.03.2014 |
| End of laying season**– Koniec sezonu reprodukcji** | 4.08.2014 | 1.08.2014 |
| Lenght of laying period, days – Długość sezonu reprodukcji, dni | 131 | 132 |
| Total number of clutches – Liczba zniesień ogółem | 39 | 16 |
| Number of clutches per female – Liczba zniesień na 1 samicę | 3.9 | 5.3 |
| Number of eggs per clutch, n – Liczba jaj w zniesieniu, szt. | 1.89 (1–2) | 1.93 (1–2) |
| Number of eggs per female per season, n – Liczba jaj od samicy w sezonie, szt. | 6.72 (1–15) | 10.33 (8–14) |

*The day when flock layed the first egg – *Dzień zniesienia pierwszego jaja.
**The day when flock layed the last egg – **Dzień zniesienia ostatniego jaja.

Data on the physical traits of the pigeon eggs are presented in Table 2. Both breeds pigeons laid eggs of similar weight, 14.82–14.85 g on average. The eggs of the studied breeds differed in length and width, which had a significant impact on their shape (Table 2). The egg shape index in Polish Owls was 73.04%, whereas in Warsaw Butterfly Tumblers it was by approx. 3% higher, and the differences were significant.

Table 2. Physical traits and egg weight loss during natural incubation of pigeon eggs ($\bar{x}$ ±SD)

Tabela 2. Wybrane cechy fizyczne oraz ubytki masy jaj gołębi podczas naturalnej inkubacji ($\bar{x}$ ±SD)

| Item – Wyszczególnienie | Polish Owl<br>Mewka polska | Warsaw Butterfly<br>Motyl warszawski |
|---|---|---|
| Egg weight, g – Masa jaja, g | 14.85 ±1.19 | 14.82 ±1.11 |
| Egg length, mm – Długość jaja, mm | $36.80^{a}$ ±1.20 | $35.94^{b}$ ±1.72 |
| Egg width, mm – Szerokość jaja, mm | $26.86^{A}$ ±0.81 | $27.26^{B}$ ±0.63 |
| Shape index, % – Indeks kształtu, % | $73.04^{a}$ ±2.91 | $75.98^{b}$ ±3.05 |
| Egg weight loss, g (%) – Ubytek masy jaja, g (%) | 4.00 ±0.89 (26.77 ±5.54) | 3.82 ±0.95 (25.78 ±5.47) |
| Chick weight – Masa pisklęcia, g | 10.38 ±1.45 (69.53) | 10.47 ±2.01 (70.65) |

Means in rows marked with different letters differ significantly (A, B – $P \leq 0.01$; a, b – $P \leq 0.05$).
Średnie w wierszach oznaczone różnymi literami różnią się istotnie (A, B – $P \leq 0{,}01$; a, b – $P \leq 0{,}05$).

The highest chick quality is achieved if the egg water loss is optimal, therefore we have analyzed also this index. The data on egg weight loss during natural incubation are presented in Table 2. The weights of the incubated eggs did not differ significantly between the breeds and averaged 14.8 g. After 18-day incubation, the weight loss ranged from 25.78 to 26.77%.

The data on the analysis of fertilization and hatchability of pigeon eggs during the analyzed reproduction period are presented in Table 3. The fertilization rate in Polish Owls was low, 64.86% of eggs, while in Warsaw Butterfly Tumblers it was by 25% higher. The highest rate of embryo mortality (22.22%) was observed in Warsaw Butterfly Tumblers. Dead embryos in Polish Owls' eggs were found in merely 1.35% of fertilized eggs.

Table 3. Evaluation of fertility and hatchability of pigeon during the breeding season

Tabela 3. Ocena zapłodnienia i wylęgowości gołębi podczas sezonu rozpłodowego

| Item – Wyszczególnienie | Polish Owl<br>Mewka polska | Warsaw Butterfly<br>Motyl warszawski |
|---|---|---|
| Number of incubated eggs, n – Jaja nałożone, n | 74 | 27 |
| Fertile eggs, n (%) – Jaja zapłodnione, n (%) | 48 (64.86) | 23 (85.19) |
| Dead embryos, n (%) – Zarodki zamarłe, n (%) | 1 (1.35) | 6 (22.22) |
| *Weak chicks, n (%) – Pisklęta słabe, n (%) | 7 (14.89) | 3 (18.75) |
| Healthy chicks, n (%) – Pisklęta zdrowe, n (%) | 40 (85.11) | 13 (81.25) |
| Hatchability of set eggs, n (%) – Wylęg z jaj nałożonych, n (%) | 47 (63.51) | 16 (59.26) |
| Hatchability of fertile eggs, % – Wylęg z jaj zapłodnionych, % | 97.92 | 69.57 |

*Chicks that died on the second day after hatching.
*Pisklęta, które padły w drugiej dobie po wykluciu.

The percentage of wobble chicks in Warsaw Butterfly Tumblers was 18.75% and was by 3.86% higher compared to that Polish Owls. Hatched chicks in Polish Owls represented 97.92% of fertilized eggs, whereas in Warsaw Butterfly Tumbler it was 69.57%.

Body weight, gains, and growth rate of the pigeons until 3 months of age are presented in Table 4. Body weights in day-old chicks of either breed were similar, 10.38–10.47 g, while on day 3 of rearing, Warsaw Butterfly Tumblers were three times heavier compared to Polish Owls. The growth rate during this period was 53.34 and 101.01% for Polish Owls and Warsaw Butterfly Tumblers, respectively. At day 7 of rearing, the pigeons breeds differed significantly in body weight. Absolute body weight gains during this period were similar in both breeds, around 57–60 g. At age 14 days, Polish Owls were by about 10 g heavier, as compared with Warsaw Butterfly Tumblers, the differences were non-significant, though. The growth rate during this period was 74.03 and 50.44% for Owls and Butterfly Tumblers, respectively. Between 14 days and 2 months of age, no significant differences were observed in body weights between the breeds (Table 4). From the second month on, the body weight of Polish Owls began to decrease, hence the growth rate during this period was negative. On the other hand, Warsaw Butterfly Tumblers gained in weight during the same period of time, and growth rate was 7.87%.

Table 4. Body weight and growth rate over pigeon rearing period ($\bar{x}$ ±SD)

Tabela 4. Masa ciała i tempo wzrostu gołębi w okresie odchowu ($\bar{x}$ ±SD)

| Item – Wyszczególnienie | Polish Owl<br>Mewka polska | Warsaw Butterfly<br>Motyl warszawski |
|---|---|---|
| Chick weight at 1 day, g – Masa piskląca w 1 dniu, g | 10.38 ±1.45 | 10.47 ±2.10 |
| Chick weight at 3 days, g – Masa piskląca w 3 dniu, g | 17.93$^{aA}$ ±5.39 | 31.79$^{bB}$ ±14.63 |
| Weight gain 1–3 days, g (%) – Przyrost masy 1–3 dzień, g (%) | 7.55 (72.75) | 21.32 (203.63) |
| Growth rate 1–3 days, % – Tempo wzrostu 1–3 dzień, % | 53.34 | 101.01 |
| Chick weight at 7 days, g – Masa piskląca w 7 dniu, g | 75.11$^{aA}$ ±15.20 | 91.69$^{bB}$ ±24.75 |
| Weight gain 3–7 days, g (%) – Przyrost masy 3–7 dzień, g (%) | 57.18 (318.91) | 59.90 (188.42) |
| Growth rate 3–7 days, % – Tempo wzrostu 3–7 dzień, % | 122.91 | 97.02 |
| Chick weight at 14 days, g – Masa piskląca w 14 dniu, g | 163.40 ±18.15 | 153.54 ±23.74 |
| Weight gain 7–14 days, g (%) – Przyrost masy 7–14 dzień, g (%) | 88.29 (117.55) | 61.85 (67.46) |
| Growth rate 7–14 days, % – Tempo wzrostu 7–14 dzień, % | 74.03 | 50.44 |
| Chick weight at 21 days, g – Masa piskląca w 21 dniu, g | 203.30 ±17.32 | 208.08 ±22.92 |
| Weight gain 14–21 days, g (%) – Przyrost masy od 14 do 21 dnia, g (%) | 39.90 (24.42) | 54.54 (35.52) |
| Growth rate 14–21 days, % – Tempo wzrostu 14–21 dzień, % | 21.76 | 30.16 |
| Chick weight at 28 days, g – Masa piskląca w 28 dniu, g | 230.20 ±22.41 | 215.15 ±26.45 |
| Weight gain 21–28 days, g (%) – Przyrost masy od 21 do 28 dnia, g (%) | 26.90 (13.23) | 7.07 (3.40) |
| Growth rate 21–28 days, % – Tempo wzrostu 21–28 dzień, % | 12.41 | 3.34 |
| Chick weight at 2 months, g – Masa ciaław 2miesiącu, g | 228.00 ±19.94 | 232.77 ±16.33 |
| Weight gain 1–2 months, g (%) – Przyrost masy ciała 1–2 miesiąc, g (%) | –2.20 (–0.96) | 17.62 (8.19) |
| Growth rate 1–2 months, % – Tempo wzrostu 1–2 miesiąc, % | –0.96 | 7.87 |
| Chick weight at 3 months, g – Masa ciała w 3 miesiącu życia, g | 216.97 ±14.89 | 216.85 ±10.22 |
| Weight gain 2–3 months, g (%) – Przyrost masy 2–3 miesiąc, g (%) | –11.03 (–4.84) | –15.92 (–6.84) |
| Growth rate 2–3 months, % – Tempo wzrostu 2–3 miesiąc, % | –4.96 | –7.08 |
| Mortality rate till 3 months, n (%) – Śmiertelność do 3 miesiąca, n (%) | 9 (19.5) | 3 (18.75) |

Means in rows marked with different letters differ significantly (A, B – $P \leq 0.01$; a, b – $P \leq 0.05$).
Średnie w wierszach oznaczone różnymi literami różnią się istotnie (A, B – $P \leq 0{,}01$; a, b – $P \leq 0{,}05$).

In the third month of life, Warsaw Butterfly Tumblers lost 15.92 g in weight and their growth rate was negative. Final body weight of both studied fancy pigeon breeds was similar, 216 g on average (Table 4). In all, the losses in chick rearing of both breeds were similar, ranging from 18.75% (Warsaw Butterfly Tumblers) to 19.15% (Polish Owls).

## DISCUSSION

Pigeons are monogamous birds that live in pairs [Saxena et al. 2008]. They reach sexual maturity at age 4–7 months from hatching. According to Darwati et al. [2010], who carried out studies in Indonesia, pigeons began laying eggs at age 221 days. Khargharia et al. [2003] report that pigeons in India reached maturity sooner, at age 166 days. In our climate, pigeons start their reproduction season in

early spring. The reproductive cycle is triggered and sustained if temperature is above zero, and feeding is intensive. According to Hetmański [2004], urban pigeons in Poland are able to reproduce all year round. The author observed that first eggs were hatched beginning October or November and the breeding lasted even till September the following year. During the fall/winter seasons, breeders of homing, fancy and meat pigeons prevent pairs from mating. A year-round reproduction season exhausts birds and chicks are poorly reared in spite of intensive feeding. In our study, the season lasted 131–132 days, while Mikulski and Pudyszak [2002] report that the number of days of laying for King pigeons was 159, and in Wrocław meat pigeons – 185 days.

A female lays most frequently two eggs per lay, one of which is laid in 8–10 days after fertilization at about 5 pm, and the other one is laid in another 44 hours, at about 1 pm [Johnston and Janiga 1995]. In our observations the hens laid 1 or 2 eggs in a lay. Some authors reported 3 eggs per lay [Pikula al. 1981, Darwati et al. 2010].

We obtained 7–10 eggs from a female during the studied reproduction season. Similar results (7.4–7.9 eggs per female per season) were reported by Abou Khashaba et al. [2009], who studied local pigeons in Egypt. Mikulski and Pudyszak [2002] stated that King and Wrocław meat pigeons laid on average 6–7 eggs. Zieleziński and Pawlina [2007], on the other hand, counted on average 13 eggs laid by Wrocław meat pigeons. Pigeons managed under farm conditions with controlled environment are able to lay as many as 22 eggs, since they breed throughout the year

The size of the hatching egg is an important factor of hatchability indices and chick body weight on hatching, which was proved by Ibrahim and Sani [2010]. Darwati et al. [2010] reported that the egg weight ranged from 10.7 to 23.3 g. In our study, hens of both breeds laid eggs with an average weight 14.8 g, which remained within the standards characteristic of the species. Urban pigeons in Nigeria, according to Ibrahim and Sani [2010], laid eggs of similar weght (14.4 g). Kabir [2013] reports that local pigeons (*Columba livia domestica*) in Bangladesh laid more lightweight eggs (11 g). Meat pigeons lay much heavier eggs, 22 g [Meleg et al. 1999, Mikulski and Pudyszak 2002]. Abou Khashaba et al. [2009] demonstrated that the weight of eggs increased significantly with the diet metabolic energy content.

The length and width of eggs reported by Bhowmik et al. [2014] was, respectively, 3.75 and 2.81 cm, which is similar to our results.

The shape of the eggs has an impact on the hatchability indices, since it determines the proper position of the embryo [Narushin and Romanov 2002]. The literature lacks data on the effect of egg shape on the hatchability of pigeon eggs. Studies on poultry have demonstrated that hatchability may become heavily

deteriorated if the shape index deviated from the species-characteristic average [Zgłobica and Wężyk 1995, Harun et al. 2001]. Darwati et al. [2010] found that egg shape index in pigeons ranged from 70.1 to 81.3% and our results remained within this range too.

It takes 17–18 days for a pigeon egg to incubate [Saxena et al. 2008]. Egg brooding is to ensure the proper development of the embryo, leading to a successful hatching and birth of the chick. Incubation is influenced by a number of factors, such as its duration, type of nursing of the brood, frequency of egg turning, fresh air supply, weather conditions, nest type, parents health status [Kwieciński et al. 2009]. Darwati et al. [2010] reported that pigeon egg weight loss during incubation may reach 6%. We obtained different results, 25.8–26.8%. According to Łukasiewicz et al. [2014], the relative weight loss during incubation of pigeon eggs ranged from 13.8 to 25.3%.

The success of avian reproduction depends also on the efficient incubation of the eggs. Hatchability indices depend on many factors, including nutrition, age of birds, conditions under which eggs are incubated, year season; hence, the literature data on the species average of this parameter for pigeons (in relation to fertilized eggs) vary substantially [Meleg et al. 1999]. Zieleziński and Pawlina [2007] found that the hatchability of homing pigeons was 90.74%, while in King and Wrocław meat pigeons it averaged 75.76–76.00%. Mikulski and Pudyszak [2002], on the other hand, reported 100% hatchability of King pigeons' eggs and 68.8% of those of Wrocław meat pigeons.

Available literature on the subject lacks reports on the growth of fancy pigeon breeds, therefore our results can be only compared with those on pigeons of other usage types. According to Nowicki et al. [2007], the highest daily gains in a pigeon's body weight are observed during the first two weeks of life, and the chick's body weight doubles within the first 48 hours. Three-week homing pigeons, according to Zieleziński and Pawlina [2011] weighed on average 191.18 g, while meat pigeons 217.7–225.9 g. Body weight gains during this period found in the report by these authors ranged from 25 g in homing pigeons to 29 g in the Kings, whereas we measured them in the range 9.2–11.60 g. According to Pawlina and Borys [2009], 7-days old Wrocław meat pigeons were 2.5–3.0 times heavier compared with the breeds we studied, which is a result of a different breeding goal. On the other hand, local pigeons (*Columba livia domestica*) bred in Bangladesh weighed on average 39.43 g in the first week of rearing [Kabir 2013].

In our observations we have found the body weight daily gains were 8.83 to 12.61 g between day 7 and day 14 of rearing, and next decreased to reach 0.47 to 1.77 g between days 21 and 28. Zieleziński and Pawlina [2011] found a similar pattern. Pawlina and Borys [2009], who studied a meat pigeon breed (Wrocław meat), noticed the drop in daily gains on the end of 4 weeks of age. The age

4 weeks is therefore the optimum when meat pigeons should be slaughtered, as their further farming would be economically inefficient.

The final body weights of the discussed fancy pigeons were similar, 216 g on average (Table 4). Studies by Zieleziński and Pawlina [2011] suggest that homing pigeons at age 3 months are twice as heavy and attain 442 g in body weight. It is not surprising that meat pigeons, as observed by these authors, weighed about 600 g.

## CONCLUSIONS

Our studies represent a starting point for further observations on the reproduction and growth rate of fancy pigeons. The results can also be used for comparative purposes for other studies carried out on this avian species.

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## ANALIZA CECH ROZRODCZYCH I WZROSTU GOŁĘBI OZDOBNYCH

**Streszczenie.** Badania przeprowadzono na gołębiach ozdobnych utrzymywanych przez prywatnego hodowcę w Polsce. Populację eksperymentalną stanowiły gołębie rasy mewka polska i motyl warszawski oraz potomstwo uzyskane od tych par w czasie sezonu rozpłodowego. W okresie rozrodczym rejestrowano liczbę zniesionych jaj przez poszczególne samice, wykonano pomiary masy jaj oraz zmierzono szerokość (oś krótka) i długość (oś długa) jaja. Wyliczono procent jaj zapłodnionych, zarodków zamarłych oraz wylęgowość piskląt z jaj nałożonych i zapłodnionych. Kontrolowano masę ciała gołębi do 3 miesiąca życia w celu ustalenia tempa wzrostu. W analizowanym sezonie rozrodczym motyle warszawskie cechowały się lepszą nieśnością (10,3 osobnika na samicę) niż mewki (6,72 osobnika na samicę). Obie rasy znosiły jaja o podobnej masie (14,8 g). Indeks kształtu jaj wynosił 73,04% u mewki polskiej, zaś u motyla warszawskiego był o ok. 3% większy i były to różnice statystycznie istotne. Zapłodnienie jaj u mewki polskiej było niskie i wynosiło 64,86%, a u motyla większe o 25%. Wylężone pisklęta stanowiły u mewki polskiej 97,92% jaj zapłodnionych, natomiast u motyla warszawskiego 69,57%. Największe przyrosty masy ciała u gołębi analizowanych ras stwierdzono w okresie od wyklucia do 4 tygodnia życia.

**Słowa kluczowe:** mewka polska, motyl warszawski, wylęgowość, masa ciała, tempo wzrostu

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