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Departament of Ecology of Wildlife Management, University of Life Sciences in Lublin, Akademicka 13, 20-950 Lublin, e-mail: marian.flis@up.lublin.pl

MARIAN FLIS

Individual quality of roe deer from field and forest hunting districts in the West Polesie Region

Jakość osobnicza saren pozyskanych w obwodach łowieckich polnych i leśnych rejonu Polesia Zachodniego

Summary. The assessment of individual quality of roe deer originating from diverse habitats in Western Polesie was carried out on the basis of variability analysis of male, female, and fawn carcasses achieved in the hunting season 2008/2009. Evaluation of male antler weight variability was an additionally analyzed element. Variability in weights of carcass and antlers in roe deer males originating from the field and forest hunting circles within the analyzed area was recorded. Individuals from field circles prevailed in reference to both carcass and antlers weight. Correlation coefficients between carcass weight vs. antlers weight for both analyzed habitats were similar, and the values were statistically significant. The highest rate of body weight gain was observed in the group of the youngest animals, which could be attributed to the intensive somatic development of animals in that life period. Carcass weight of roe deer females increased during the life, while the feature variability in animals originating from different hunting circles types was negligible and statistically insignificant, although animals from field circles prevailed in the majority of age groups. Considering fawns, larger body weight diversification occurred in reference to sex rather than site where they were obtained, though these differences were statistically insignificant. Results of bi-factorial variance analysis taking into account the interaction between the animals' age and origin indicated that body weight variability in adult roe deer – regardless of their sex – was determined by the age, while male antlers weight was affected both by the animal's age and habitat. For fawns, carcass weight depended mainly on sex, not the origin.

Key words: roe deer, body mass, ontogenetic quality, antlers, West Polesie Region

INTRODUCTION

Assessment of animal's ontogenetic quality is one of the principle elements of a knowledge on particular species populations. In most cases, that type of analysis is based on body weight evaluations and – in the case of wild animals – on carcass weight,

which is a direct reflection of their body weight. For bucks, the antlers weight analysis is additional element, because it is dependent on their size, and at the same time, that trait is highly correlated with animal's carcass weight [Dziedzic 1991, Flis 2005, Dziedzic and Flis 2006].

Both body weight, and antlers weight in the case of bucks as being the expression of their individual form, is also the indicator of habitat conditions particular individuals live in. Moreover, these features depend on population density over a given area [Andersen and Linnel 2000]. Due to the fact of annual cycle of growing and falling the antlers, their mass changes resulting from their form, are an objective reflection of the interactions between the environment the deer living in particular years of their lives [Pélabon and Van Breukelen 1998, Kjellander *et al.* 2006, Toïgo *et al.* 2006, Vanpé *et al.* 2007, Flis 2008].

MATERIAL AND METHODS

Material for study consisted of roe deer carcasses gained in hunting inspectorates of Polesie Lubelskie. The analysis included the assessment of buck, hind, and fawn carcasses weights, as well as antlers weight in the case of male roe deer. In total, data from 1208 individual animals were analyzed, including 883 bucks, 225 hinds, and 100 fawns. The male roe deer carcass weight data were achieved from the documents on the cull correctness, to which antlers from all gained roebucks were submitted along with documentations of weighing (1 kg accuracy) the cooled carcasses supplied to the purchase centers. The buck antlers weights were determined by means of a direct weighing on laboratory scales with 1 g accuracy. Hind and fawn carcass weight was determined by direct weighing with 1 kg accuracy at purchase centers. Animal's age was estimated on a base of dentition wear level, which is commonly applied in hunting practice [Trense 1981, Pielowski 1999, Przybylski 2008].

Collected material was divided into groups related to the gain place, i.e. animals gained in field-type and forest-type hunting inspectorates, taking into account the elements associated with these categories. The field-type hunting inspectorates compose of areas, in which the total share of the forests – regardless of the form of ownership – is not more than 40% of the area [Ustawa… 1995]. Among bucks and hinds, 5 age groups were distinguished, while sex groups were formed from analyzed fawns. In order to determine the influence of age and gain place on analyzed traits, two-way variance analysis for unequal populations of subgroups, was performed. Determinations of the difference significance between mean values of carcass and antlers weights were made using Tukey test for unequal populations.

The study area consisted of the field-type and forest-type hunting inspectorates within Western Polesie, which is the Polish part of Polesie region. Regarding the landscape, the area is a plain with small surface inclinations and swamps resulting from difficult water outflow. Therefore, there are numerous aqueous and peat ecosystems in Polesie region, which makes the area one of the most attractive and ecologically diverse Lublin regions. Mosaic habitats, only slightly disturbed by a man, are characterized by an abundance of plants and animals living in shaping biocenoses [Kondracki 2000].

The Polesie region is characterized by the presence of not very fertile soils, mainly luvisols and cambisols developed from loamy sands, and locally histosols. Calculated general index of agricultural production area is 54.2 points, which is the lowest for entire Lublin region. The Polesie region is characterized by low intensification of agricultural production, which also contributes to the mosaic habitats formation of studied area. Rye, oat, and potato dominate as crops with low demands for soil quality. All these facts make that studied area is distinguished by locally high afforestation percentage reaching 30%. Due to high water resources resulting from rainfalls and shallow ground water levels, its major part is covered with meadows, swamps, and peats characterized by numerous bushes and trees forming specific ecotone zones [Kondracki 2000, Witek 1991].

RESULTS

Average weight of 2-years-old bucks carcass from the field-type inspectorates amounted to 15.5 kg, which was by 0.6 kg more than mean value of this trait at the same age animals from forest-type inspectorates (tab. 1), however the difference was statistically insignificant ($P \geq 0.05$). In the group of 3-years-old bucks, mean carcass weight of roe deer males from the filed-type areas was found to be 17.5 kg, while bucks from forest inspectorates were lighter by 0.6 kg, as similar as in above discussed group, and the difference was statistically insignificant either. The largest disproportion of male roe deer carcass weights between field and forest-type inspectorates was recorded for 4-years-old animals, which amounted to 0.8 kg, and again the difference was not statistically significant. The 5-years-old bucks gained in the field-type areas weighed 18.7 kg on average, whereas mean weight of the same age animals from the forest inspectorates was 18.0 kg. Difference at the level of 0.7 kg was statistically insignificant. Regarding the the oldest group, carcass weight disproportions of the male roe deer from the field and forest-type inspectorates, were the smallest (0.2 kg), which was statistically insignificant difference.

Antlers of the youngest age group of bucks from the field-type inspectorates weighed 173.8 g, which was heavier than mean value of this trait for male roe deer from the forest-type areas by 8 g. The difference was statistically insignificant ($P \geq 0.05$). Regarding to the antlers weight, animals from the field-type areas dominated within the group of 3-years-old males; their average antlers weight amounted to 272.2 g. Mean antlers weight at bucks from the forest-type inspectorates was at the level of 260.5 g, and the difference was statistically insignificant. Average weight of antlers of the 4-years-old male roe deer was 365.3 g and that difference was statistically significant ($P \geq 0.05$) from the mean antlers weight of males from the forest-type areas (330.9 g). The 5-years-old bucks from the field-type inspectorates had antlers by 9.2 g heavier than those from the forest-type areas, but such difference was statistically insignificant. Within the oldest age group, also antlers of bucks from the field-type areas were heavier than those of male roe deer from the forest inspectorates, although the difference was statistically insignificant. The correlation coefficient between carcass weight and antlers weight of bucks from the field-type inspectorates was $r_{xy} = 0.62$, while in the case of

male roe deer from the forest-type areas, it reached $r_{xy} = 0.58$ value, which was statistically significant in both cases.

Table 1. Body weight (kg) and antlers weight (g) of the male roe deer
Tabela 1. Masa tuszy (kg) i masa poroży (g) samców saren

Age Wiek		Body weight Masa tuszy		Antlers weight Masa poroży	
		category of hunting district kategoria obwodu łowieckiego			
		field polny	forest leśny	field polny	forest leśny
2	n	149	90	149	90
	$\bar{x}$	15.5	14.9	173.8_x	165.9_x
	SD	2.3	2.4	58.3	59.3
3	n	69	60	69	60
	$\bar{x}$	17.5	16.9	272.2_x	260.5_x
	SD	2.7	2.4	90.8	66.2
4	n	118	103	118	103
	$\bar{x}$	18.9	18.1	365.3_x	330.9_y
	SD	2.1	2.0	68.2	60.1
5	n	46	43	46	43
	$\bar{x}$	18.7	18.0	370.3_x	361.1_x
	SD	2.0	2.5	73.6	74.4
6-years old 6 lat i starsze	n	113	92	113	92
	$\bar{x}$	18.6	18.4	382.3_x	366.4_x
	SD	2.4	2.3	88.2	67.8

x, y – the average antlers weights marked with the same letter do not differ significantly $P \geq 0.05$
x, y – średnie masy poroży oznaczone tą samą literą nie różnią się statystycznie istotnie $P \geq 0,05$

As similarly as for bucks, weight of hind carcass increased during their ontogenetic development with the lowest value for the youngest females (tab. 2). Regarding to the 2-years-old female roe deer, the trait differentiation between areas was slight and amounted to 0.1 kg. At the same time, hinds were heavier than bucks of that age group, regardless of the origin area, by 1.8 kg, on average. For the 3-years-old hinds, mean carcass weight was identical for animals from the field and forest-type inspectorates, which was 18.1 kg; that value was by over 1 kg higher than average carcass weight of bucks from the same age group. A remarkable differentiation of the carcass weight depending on the gain area was recorded for the group of 4-years-old female roe deer. Hinds gained in the field-type inspectorates weighed 18.3 kg, while those in the forest areas were lighter by 0.9 kg; nevertheless, the difference was statistically insignificant ($P \geq 0.05$). Among the 4-years-old hinds, difference of their carcass weights between areas amounted to 0.1 kg. Female roe deer of the oldest age group gained in the field-

type hunting inspectorates were heavier by 1 kg than those of the same age group, while from the forest-type areas, although the difference was statistically insignificant ($P \geq 0.05$). Starting from the 4 years of life, regardless of the gaining area, the value of carcass weight prevailed at bucks rather than at hinds. The largest difference was observed between the oldest age animals from the forest inspectorates, in which male roe deer were by 1 kg heavier than females, but the difference was statistically insignificant ($P \geq 0.05$).

Table 2. Body weight (kg) of the female roe deer
Tabela 2. Masa tuszy (kg) samic saren

Age Wiek		Category of hunting district Kategoria obwodu łowieckiego	
		field polny	forest leśny
2	n	32	8
	$\bar{x}$	17.1	17.0
	SD	3.1	1.1
3	n	35	24
	$\bar{x}$	18.1	18.1
	SD	1.8	1.8
4	n	29	12
	$\bar{x}$	18.3	17.4
	SD	2.0	2.1
5	n	22	13
	$\bar{x}$	17.9	17.8
	SD	1.9	1.5
6-years old 6 lat i starsze	n	42	8
	$\bar{x}$	18.4	17.4
	SD	2.3	1.8

Table 3. Body weight (kg) of the roe deer fawns
Tabela 3. Masa tuszy (kg) koźląt

Sex Płeć		Category of hunting district Kategoria obwodu łowieckiego	
		field polny	forest leśny
♂	n	26	8
	$\bar{x}$	12.8	12.8
	SD	1.5	1.8
♀	n	46	20
	$\bar{x}$	12.1	12.0
	SD	1.8	2.5

Mean weight of male fawn carcass from the field-type hunting inspectorates amounted to 12.8 kg, which was identical to that for fawns from the forest areas. Female fawns from the field areas weighed 12.1 kg on average, while those from the forest inspectorates were by 0.1 kg lighter. Disproportions in carcass weights between male and female fawns from both types of hunting inspectorates were larger amounting respectively to 0.7 kg and 0.8 kg, but the difference was statistically insignificant ($P \geq 0.05$).

The two-way variance analysis referring to the variability of adult animals carcass weights as well as male roe deer antlers taking into account the interactions between the hunting inspectorate type and animal's age indicates that the age of male roe deer and hunting area significantly affect their body weight. The age and hunting inspectorate type also influenced on bucks antlers weight. In the case of female roe deer carcass weight, the age factor had prevailing effects, while the type of hunting area had no significant impact of that trait. Analysis of the sex and hunting inspectorate type influences on the carcass weight was carried out for fawns, which revealed that the sex factor, along with the hunting area category did not exert any remarkable effect of their carcass weight.

DISCUSSION

Comparing the literature references on that part of Poland [Dziedzic 1991, Dziedzic and Flis 2006, Flis 2005], it is prominent that the carcass weight of the youngest bucks gained at present from the field-type inspectorates is slightly higher (0.4 kg), while lower (0.2 kg) at those gained in the forest areas, than for male roe deer from Lublin region in 1977–1983. In older age groups, the carcass weight of presently gained bucks in the forest areas is similar to that for bucks gained within Lublin region in 1977–83, whereas that from the forest inspectorates in higher at present than in 1977–83 [Dziedzic 1991]. The carcass weight of the youngest bucks from the Polesie region – regardless of the hunting area type – is nowadays higher than that of male roe deer gained from Lublin Upland in 2001–2003. In older age groups, the difference becomes equal and bucks from the culmination age group gained in Polesie at present – regardless of the hunting inspectorate type – are lighter than those gained in Lublin Upland in 2001–2003 [Dziedzic and Flis 2006]. Studies performed by Flis [2005] in three areas of Lublin region reported average carcass weight of the 2-years-old bucks gained from Poleski National Park due to reduction cull at the level of 13.5 kg, while the oldest male roe deer from the same region weighed 17.8 kg. Therefore, the bucks gained at present from Polesie region – regardless of the hunting area type – are heavier than those from Poleski National Park. The carcass weight of bucks gained within the same period in the field and forest-type hunting inspectorates in Lublin Upland was higher than that for male roe deer from Polesie region. Considering the antlers weight, animals gained from Lublin Upland also dominated, although disproportions were smaller in older age groups, namely for bucks from the forest-type hunting areas. In the case of hinds, these disproportions were negligible and in the most of age groups, individual animals from Lublin Uplands also prevailed [Flis 2010]. Wajdzik *et al.* [2007], when assessing the ontogenetic quality of bucks from Cracow surroundings, reported average carcass weight of the youngest bucks at the level from 13.3 to 16 kg. And similarly, carcass

weight of bucks gained in the field-type inspectorates of Polesie was close to the maximum value reported by above authors, whereas for male roe deer from the forest areas, the mean carcass weight is almost the same as mean value for bucks from Cracow surroundings. Bucks of the oldest age group gained within Polesie – regardless of the habitat they lived – were characterized by higher average carcass weight than those from Cracow gained in 1999–2004.

Both at bucks and hinds, the fastest carcass gain rate occurred for animals in the youngest age groups. The annual body mass gain of the 2-years-old bucks – regardless of the living habitat – was about 13%, while that of hinds at the same age was lower amounting to about 6%. Andersen and Linnell [2000] performed studies upon roe deer population in Central Norway and found the decrease of body weight rate along with the increase of population density. Moreover, they reported the roe deer body weight as a factor that clearly affected their reproducibility. Here achieved results on fawn carcass weight confirm the thesis by Gaillard *et al.* [1993] on a lack of a difference in fawn body weight in reference to their sex.

Weight of antlers at the youngest examined bucks was by about 25 g higher than that of male roe deer gained in Lublin region in 1977–83, while average value of this trait for the oldest bucks was by about 30 g higher [Dziedzic 1991]. Also mean antlers weight of the oldest bucks analyzed was by over 40 g higher than that of bucks gained in Lublin region in 2001–2003 [Dziedzic and Flis 2006]. Flis [2005] reported mean antlers weight of the youngest bucks from Polesie National Park at the level of 154.5 g, whereas that of the oldest age group from the same area as 291 g. Achieved results indicate that the antlers weight at male roe deer originating from Polesie and gained in 2008/2009 was higher than that from Poleski National Park in 1999–2003 – regardless of animal's age – although antlers from hunting season 2008/2009 were heavier by over 80 g. High values of the correlation coefficient between carcass weight and antlers weight seems to be a confirmation of the thesis announced by various authors [Vanpé *et al.* 2007], that antlers size is a considerable phenotypic element of roe deer ontogenetic quality assessment.

CONCLUSIONS

1. The largest differentiation of body weight of animals from various habitats occurred at bucks, although the largest differences were found for the youngest age groups. That trait was less diverse at hinds and fawns, therefore the analyses allow for concluding that the habitat type does not exert any significant influence on a carcass weight at adult animals, namely from the older age groups.

2. The largest rate of body weight gain – both at bucks and hinds – occurred between the first and second age groups (2–3-years-old), which was contributed to intensive somatic development that time. In addition, hinds dominated in younger age groups regarding to the carcass weight – regardless of the origin area – while bucks in the oldest groups.

3. The differentiation of antlers weight at bucks from various types of hunting inspectorates was recorded. For all age groups, heavier antlers were present at bucks from the field-type hunting inspectorates, although the statistically significant difference was

observed only in the case of the 4-years-old male roe deer. Results from the two-way variance analysis allowed for concluding that the antlers weight was remarkably determined by animal's age, but also the environmental influences.

4. Value of correlation coefficient between carcass weight and antlers weight of bucks from the field-type hunting inspectorates amounted to $r_{xy} = 0.62$, while in the forest-type areas $r_{xy} = 0.58$; the differences were statistically significant in both cases.

5. Considering the sex groups, there was no diverse carcass weights, and that trait differentiation occurred among male and female roe deer originating from the same habitats, although the differences were not statistically significant. Thus, the analyses indicate only slight impact of sex and the gaining place on the body weight at fawns.

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Streszczenie. Ocenę jakości osobniczej saren, pochodzących ze zróżnicowanych środowisk Polesia Zachodniego, prowadzono w oparciu o analizę zmienności masy tuszy kozłów, kóz i koźląt, pozyskanych w sezonie łowieckim 2008/2009. Dodatkowym elementem analizy była ocena zmienności masy poroży u samców. Wystąpiło zróżnicowanie masy tuszy i masy poroży kozłów pochodzących z obwodów łowieckich polnych i leśnych analizowanego obszaru. Zarówno pod względem masy tuszy, jak i poroży przeważały osobniki pochodzące z obwodów polnych. Współczynnik korelacji pomiędzy masą tuszy a masą poroży dla obydwu analizowanych środowisk był zbliżony, a jego wartości były statystycznie istotne. Największe tempo przyrostu masy ciała wystąpiło w grupie osobników najmłodszych, co powiązać można z intensywnym rozwojem somatycznym zwierząt w tym okresie życia. Masa tuszy samic zwiększała się w życiu osobniczym, a zróżnicowanie tej cechy u zwierząt pochodzących z różnych typów obwodów było niewielkie i statystycznie nieistotne, przy czym w większości grup wiekowych pod względem tej cechy przeważały zwierzęta pochodzące z obwodów polnych. U koźląt wystąpiło większe zróżnicowanie masy ciała ze względu na płeć niż na miejsce pozyskania, lecz różnice te były statystycznie nieistotne. Dane dwuczynnikowej analizy wariancji z uwzględnieniem interakcji wieku zwierząt i rejonu pochodzenia wskazują, że zmienność masy ciała u osobników dorosłych niezależnie od płci warunkowana jest wiekiem zwierząt, a na masę poroży kozłów wpływ ma zarówno wiek zwierząt, jak i środowisko, w jakim żyją. U koźląt masa tuszy uzależniona była głównie od płci, a nie od rejonu pochodzenia.

Słowa kluczowe: sarna, masa ciała, jakość osobnicza, poroże, Polesie Zachodnie