



## Morphological features of wild boar individuals of semi-free content

Anzhelika A. Gorbacheva <sup>1\*</sup>, Oksana V. Vorobyova <sup>1</sup>, Tatyana A. Litvintseva <sup>1</sup>,  
Svetlana V. Korolkova <sup>1</sup>, Alexander V. Kosov <sup>1</sup>

<sup>1</sup> Belgorod State University, 85, Pobedy St., Belgorod, 308015, RUSSIA

\*Corresponding author: [gorbacheva@bsu.edu.ru](mailto:gorbacheva@bsu.edu.ru)

### Abstract

The article reflects the results of the study of morphological features of wild boars of semi-free content on the basis of their comparison with the corresponding parameters of wild boars. The topicality of the problem is based on the ecological problem of reducing the number of wild boar in relation to the anthropogenic impact on the environment. The study was conducted from 2011 to 2013 on the basis of a hunting farm in the closed joint-stock company «Belaya ptitsa» (Prokhorovsky district of the Belgorod region). The essence of it was a comparison of parameters of wild boar and individuals of semi-free content obtained during the measurement of the mass of carcasses, measurements of their skulls and internal organs. The studied carcasses were divided into several groups: piglets of the current year of birth (segoletes), two-year-olds and adults. Also, the division was carried out by gender (males and females). The study showed that individuals of wild boars of semi-free content surpass wild boars in the intensity of growth and development of the skeleton, the length of the skull and the mass of internal organs (except for the kidneys).

**Keywords:** wild boar, semi-voluntary content, heart, kidney (renal), liver, lungs, weight, female, male, young of the year

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## INTRODUCTION

Wildlife population management is one of the most sought-after areas, both hunting and ecology in general. However, it is not possible to carry out such activities without careful study of the populations of such animals. Currently, mouse-like rodent populations are relatively well studied, whereas individual issues on larger mammals remain little studied. Among hoofed mammals, an interesting object for such research is a wild boar (Markov and Goldin, 2016; Yamamoto, 2017). This species is part of a trophic chain of mixed forests. A boar, acting on the soil component, regulates the whole structure of biocenosis (Holzbauer, Agger, Hall, Johnson, Schmitt, 2014; Bulakhov, Pakhomov, Pilipenko, 2015; Alemayehu, et al, 2016). At the same time, it is known that the grubbing activity of the boar is uneven in the seasons of the year, which also affects the structure of biocenosis and its reproduction (Zavaleeva, Shamraev, Godina, 2018; Antonets, 2013). A boar is one of the favorite hunting objects in many regions of Russia (Antonets, Yarysh, 2015; Gubin, Kaledin, Koltsov, 2019), (Sales, Kotrba, 2013). This species is omnivorous; however, it is noted, that the diet is based on a plant food (Moskvitin and Marchenko, 2007; Kulpin, 2008). Due to the diverse ecological conditions of the boar existence, it is almost widespread. In addition to the

features listed, relative to other wild hoofed animals, a wild boar is characterized by high fertility. Data obtained by Arshavsky (1977) indicate that domestic pig breeds, which are direct descendants of wild boar, have significantly lower life expectancy than wild boars (Arshavsky, 1977). It is also noted that the low life expectancy of domestic pigs is associated with early puberty and some shortening of the pregnancy period, which are genetically fixed signs necessary for humans to increase the productivity of domestic pigs.

Later puberty corresponds to the later formation of morphological signs of the wild boar. A wild boar grows slowly and reaches its full development by the age of five to six (Suvorov and Shirokovskaya, 2016; Gavrila, Strugariu, Oroian, 2016; (Postolache, Ciobanu, Boișteanu, 2015). At one year age a wild boar pig have a weight of 48-50 kg, while individuals of the same age of domestic pigs - not less than 100-120 kg (Putnin, 2009). Thus, the skeletal calcification in domestic pigs ends at the age of two, while in wild boar it happens only after three years (Ninov, 1980; Belenkov, Shilova, Barsegova, Pilipenko, 1981; Belenkov, 2001; Knyazev,

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Shatokhin, Goncharenko, Frolova, Zaporozhets, Ermolaev, Nikitin, 2015). According to Ninov (1979, 1980), the tubular bones of the wild boar limbs are longer with well-developed buggers and ridges, relative to these sites in domestic pigs, indicating greater wildlife mobility, and therefore more advanced muscle (Ninov, 1980; Belenkov, Shilova, Barsegova, Pilipenko, 1981; Belenkov, 2001; Knyazev, Shatokhin, Goncharenko, Frolova, Zaporozhets, Ermolaev, Nikitin, 2015; Ninov, 1979).

At the present time, there has been a sharp decline in the number of the most popular hunting facilities, including a wild boar. Any anthropogenic intervention affects wildlife habitat (Revutskaya, 2014; Massolo, Roberto, Meriggi, 2007). And in general, Russia's hunting industry is experiencing a certain crisis. The end result of the hunters' action is a prey. The purpose of hunting farms is to provide hunters with the prey and, at the same time, rational use and reproduction of hunting resources. The modern hunting use system is often determined by the level of recreational, compensatory and conservation functions of the hunting farm (Kozlov, 2018; Hodgkinson, Cárcamo, López, 2011). In unfavourable epizootic situations, breeding of animals in free-standing conditions becomes essential assistance (Ostapchuk, 2017). Therefore, in various regions, farms using the so-called paramilitary content of wild animals are becoming increasingly popular. In the territory of the Belgorod region, this type of boar maintenance was used in Prokhorovsky district by the hunting farm of ZAO «Belaya ptitsa» (White Bird). In connection with this economic activity, this organization may constitute in some sense a scientific and practical basis for studying the ecology of the population of hunting animals (Ostapchuk, Kaledin, & Wachow, 2019).

Given that animals partially contained in enclosures received certain advantages relative to wild brethren, the development of somatic muscle, internal organs in young animals and the next generation of boars should also proceed at a faster rate.

The purpose of this research was to identify the dynamics of the skeletogeny and internal organs of the next generations of wild boar of semi-liberal keeping.

## MATERIAL AND METHODS

The research was carried out from 2011 to 2013. The base of the research was the hunting farm of ZAO «Belaya ptitsa» of Prokhorovsky district, where several individuals of European boar were brought to keep them in a semi-liberal condition. This farm obtained a license for the semi-liberal breeding of commercial animals. The material was served by young live animals and carcasses of shot wild boars of different ages in this area, as well as corpses of fallen wild individuals of the group of sегоlets. Shooting of animals was carried out in autumn-winter period, i.e. during hunting on feeding

grounds in 2013. At the same time, the distinctive feature of boars of semi-liberal keeping was the stamp on one of ear sinks. Due to the less problematic existence of animals belonging to ZAO «Belaya ptitsa», there were no bodies of gilts in this hunting company during the period of research, so the measurements were removed from live objects. While in the wild there were found several bodies of piglets of this year of birth. In the corpses of wild piglets, in addition to common surveys, after treatment of skulls and limbs, measurements were taken of the lengths of individual skull bones and limbs.

Two-meter roulette, stem and scales with accuracy of 0.05 kg were used for measurement of boar carcasses. The weight of the packaging in which the weighing was carried out was 800 g, which was taken into account in the weighing of the organs.

The conditions of Prokhorovsky district are quite favorable for the boar, so in the bands of wild animals there is a more or less stable age composition (Linkov, 2012). In this research was obtained data from different age groups of both sexes. The age was determined by linear dimensions, hair cover structure and features of dental system development.

During the study of skulls, the following parameters were measured: sagittal length of the skull, frontal, chilli, nasal and lacrimal bones, skull width, height of the upper and branch of the lower jaws, width of the large occipital hole and length of the jugular spines.

The mass and measurement of internal organs were determined only by those of particular nutritional value to humans. These include liver, heart, kidneys and lungs. Weighing of the carcasses was carried out before anatomization and after removal of internal organs.

All the carcasses studied were divided into several groups: piglets of the current year of birth (this year's brood), two-year-olds and individuals, over three years old (adults). In each of the groups, both males and females were analyzed. In the group of this year's brood, due to the absence of departure in ZAO «Belaya ptitsa», there was no comparison of internal organs. Only the indicators of the Constitution have been analyzed. The total number of individuals of different age boar studied was 67 heads. Among female segulae, six individuals in each group were analyzed, while in males in the group of wild animals eight heads were shot, and in the group of semi-liberal keeping measurements were carried out on seven individuals. In the remaining groups, the analysis was carried out on five animals.

In order to determine the body weight of live animals, the method of determining it by measurement was used (Lebedko, 2006). At the same time, since it is not possible to determine with accuracy which category of potency these individuals will belong to, a formula was used in which it was necessary to calculate the heart girth behind the plate-bones and the length of the truncus. The main measurements characterizing the animal's size and the proportions of its physique in

addition to those listed are the height in the canvas, the oblique length of the torso and the girth of the heel. All the above indicators were used to compare different age groups of wild boars of free and semi-white content.

The results were processed by methods of variation statistics using Excel 7.0 and Statistica 6.0 computer programs. The difference between the values of the compared groups was determined by the Student's two-tap t-criterion. Changes have been taken for statistically significant level at  $p \leq 0.05$ .

## RESULTS AND DISCUSSION

The age of the animals in half-life was known. To determine the age of the shot wild boar, a well-known dental formula counting scheme has been used which is most accurate with respect to other techniques. Since the cloven-hoofed animals of this species were divided into groups of piglets, two-year-olds and adult animals, the following guidelines were used. Piglets aged of 6-12 months have 36 teeth, of which the third milk incisive tooth is replaced by a permanent one, and the first and second begin to rub off. At this age there is a change of canine milk teeth. Usually at the age of 12 months, the change of teeth to permanent ones is already ending. Smoothed chewing beads already appear on the first large grinding tooth in 10-12 months, and the chewing surface of the third premolar has a cone-shaped shape.

At the age of two, boars have 40-42 teeth, a second grinding tooth is fully developed, and a third grinding tooth begins its development. Whereas all premolars already have erased tooth crest and are somewhat deformed. Males and females have fangs.

At the age of three years the boars have 44 teeth, the incisive teeth are weakly erased. The first and second molars begin to wash. At the age of four, all teeth are erased, and traces of dentin appear on the third dentine (Klevezal, 2007).

Analysis of the body weight values of the individuals studied showed that there were well-marked weight differences between males and females, and this trend was observed in both groups of wild animals and in groups of individuals of semi-liberal content. When comparing weights, there is a significant difference between wild and semi-male females. Thus, individuals of semi-liberal content slightly exceed females by weight –  $99.4 \pm 0.26$  kg - in females of semi-female content relatively  $92.1 \pm 0.17$  kg - in wild females. And in height in the withers, the difference between wild and half-wild individuals is insignificant. Thus, adult wild female boar had average values of this parameter  $73.8 \pm 0.23$  cm, whereas females of semi-liberal content –  $75.2 \pm 0.25$  cm.

The weight of adult wild boar males and semi-liberal males was virtually the same and was  $142.3 \pm 7.3$  kg and  $144.6 \pm 4.7$  kg respectively.

Differences in weight characteristics and constitutional parameters are also clearly visible in

groups of piglets. Thus, male of this year's brood of wild boar population are 30% higher than the weight of males of this group of semi-liberal content. Whereas female this year's brood of the wild population are hardly different in weight from female of this year's brood of the second group and make up  $32.3 \pm 0.29$  kg. and  $32.4 \pm 0.42$  kg respectively.

In two-year-old females, weight differences are more pronounced, which will be fixed in females in adulthood. So the weight of wild females of two years of age averaged  $63.4 \pm 4.3$  kg. And  $74.2 \pm 1.7$  kg for two-year-olds.

An indicator of skeleton development is the girth of the chaps, length and width of the head (skull). In all groups of pigs studied, the bone system development benefits are observed in individuals of semi-liberal content, possibly due to the presence of sufficient mineral feed, which was additionally obtained by individuals of semi-liberal content. The exception is the width of the head. Thus, in the male of this year's brood it exceeded that in the group of semi-liberal content and was  $28.0 \pm 0.3$  cm - in wild animals and  $35.2 \pm 0.2$  cm - in the group of semi-liberal content. Two-year-olds and older boars have reverse dependence. In two-year-old wild boar, the head width is 3% higher than in male boar of semi-liberal content and is  $40.1 \pm 3.1$  cm. Even greater difference is noted in the study of this parameter in the group of adult males. Here, the wild adult boars have a head width of 5.7% greater than that of a given group of semi-liberal content. This may be due to the easier method of fodder production provided regular feeding is provided by the semi-liberal method of maintenance of cloven-hoofed animal.

The length of the head in all groups of males and females is of great importance in members of the semi-liberal content. Thus, in wild boars in groups of this year's brood, two-year-olds and adults, the average data of this parameter are respectively  $44.3 \pm 0.2$  cm;  $47.1 \pm 0.3$  cm;  $48.3 \pm 0.5$  cm. At animals of semi-liberal content these indicators were  $45.3 \pm 0.3$  cm,  $49.3 \pm 0.7$  cm and  $51.1 \pm 0.1$  cm in groups of this year's brood, two-year individuals and adult boars. In wild boar females, the head length is in the group of this year's brood –  $40.3 \pm 0.2$  cm; In two-year-olds –  $44.7 \pm 2.1$  cm and  $47.1 \pm 0.2$  cm - in adult females. Females of semi-liberal content had the following indices:  $42.3 \pm 0.4$ ;  $46.1 \pm 2.1$  and  $48.3 \pm 0.2$  cm respectively, groups of this year's brood, two-year-olds and adults.

The greatest difference in metacarpus was in comparable groups of male of this year's brood and adult animals. Thus, in groups of male of this year's brood, the semi-liberal content piglets had a larger girth of metacarpus. Their average indexes were 10.7% higher than that of the semi-liberal content group. In the groups of adult males, the difference in average values of metacarpus girth was 15.8%, while in males of two-year-

**Table 1.** The average weight of internal organs of males of a wild boar, g

Organs	Two-years specimen		Males, adult specimens	
	Wild animals	Animals of semi-liberal content	Wild animals	Animals of semi-liberal content
Heart	1090±105	1100±110	1300±105	1490±110*
Liver	2060±23	2180±95	2270±93	2305±65*
Kidneys	649±29	500±29	705±23*	674±15
Lungs	514±33	623±33	625±32	773±25*

Note –\*validity of differences compared to two-year-olds according to Student's t-criterion

olds this difference was only 3.3% in favor of boars of semi-liberal content.

After opening of the shot adult animals, the organs such as liver, heart, kidneys and lungs were weighed. Kidney weighing was carried out simultaneously on both the right and left. Since in the group of this year's brood individuals of semi-liberal content were not clogged, the assessment of internal organs in these groups was not carried out. In addition, somatic muscle, its development and presence of fat deposits were visually evaluated. The weight of the internal organs of animals of different groups is shown in **Table 1**.

The mass of all analyzed internal organs of male boar in all groups of animals of semi-liberal content is slightly larger than the mass of these organs in the group of wild animals. The exception is made by kidneys. Their mass is 23% more in the group of wild two-year-old individuals and 3.5% more in adult males removed from the wild population of boar of Prokhorovsky district relative to the mass of these organs in the groups of semi-liberal content.

In females, there is also a weight advantage of the semi-liberal content group organs relative to wild animals. At the same time, there is also no large difference in the weight of these organs. The mass of organs in groups of female of wild population and semi-liberal content is roughly the same. Thus, the adult females of wild boar population, with an average weight of 92.1±0.17 kg, have a heart with a weight of 1035±85 g, and in females of the same age category of semi-liberal content, the weight of this organ was 1047±83 g. The weight of the heart of two-year-olds was 980±37 g (in wild females) and 1010±23 g (in females of semi-liberal content).

Two-year-old females removed from the wild animal population had a liver weight of 1477±29 g, and individuals of semi-liberal content of 2023±103g. The

liver weight of adult wild females averaged 2,085±27 g, while in adult animals of the second group - 2120±38 g. The weight characteristics of lungs in females of wild population and females of semi-liberal content hardly differs. In two-year-olds in the both groups, the lungs weighed an average of 633±35 g, in adults the lungs were slightly larger in wild pigs and their average weight was 765±34 g, while in females of the semi-liberal content of this age group was 724±43 g.

The kidneys of females, their weight characteristics, unlike those of males, are hardly different in different age groups between wild members and individuals of semi-liberal content. Thus, in groups of two-year-olds, the kidneys of wild females by weight are only 1% lower than those of females of semi-liberal content. In adults, the weight parameters are slightly higher and average 700±35 g in wild individuals and 702±34 g in the second group of this age category.

## CONCLUSION

According to studies carried out, the faster growth and development of the skeleton of individuals of both sexes at semi-liberal content was revealed. The exception was females of this year's brood group; Their average animal weight was virtually the same as that of wild animals.

There are also some features in the proportions of the head. Thus, the average value of skull length in different age males and females of both groups of content (wild and semi-liberal) is greater in groups of pigs of semi-liberal content. And the average head width rates in two-year-olds and adult males are significantly larger in wild members of these groups. Whereas females tend to have higher rates in semi-liberal animals. In groups of this year's brood the both indices, length of head, and width of head, are more in groups of semi-liberal content.

The study of the internal organs revealed the following patterns - in groups of males - and two-year-olds, and adult animals - the average kidney weight is slightly less in animals of semi-liberal content, relative to that of wild members of this species.

By the weight of the rest of the organs, this pattern was not observed. All animal organs from the semi-liberal content groups in average is more by the mass of animal organs removed from the wild population.

## REFERENCES

- Alemayehu Y, Adicha A, Mengistu M, Eshetu B (2016) Assessments of Market Oriented Beef Cattle Fattening System Under Farmer Management Condition in South Omo Zone of Snnpr. *Current Research in Agricultural Sciences*, 3(3): 31-45.
- Antonets NV (2013). Renewal of oak under the influence of the environment-forming activity of the boar. Gerany, LAP LAMBERT: Academic publishing, 254. (In Russian)
- Antonets NV, Yarysh VL (2015). Environment-forming activity of wild ungulates of the Karadag nature reserve. In the book: 100 years of Karadag scientific station. T. I. Vyazemsky. SB. scientific papers of SBI NOP RK «Karadag

- nature reserve», FSBIS «Institute of marine biological studies». Simferopol, Publishing house of N. Orianda: 361-371. (In Russian)
- Arshavsky IA (1977). Physiological mechanisms of mammalian life expectancy. *Advances in modern biology*, 83 (2): 213-217. (In Russian)
- Belenkov EP (2001). Postembryonal growth of the skeleton of pigs of different breeds. Improving the technology of production of livestock products in Siberia. *Novosibirsk*: 67-73. (In Russian)
- Belenkov EP, Shilova AV, Barsegova LA, Pilipenko VP (1981). Features of the development of the skull of pigs of different breeds. In the book: *pig Breeds*. M., Kolos: 218-233. (In Russian)
- Bulakhov VL, Pakhomov AE, Pilipenko EN (2015). Influence of the burrowing activity of the boar (*Sus scrofa* Linnaeus, 1758) on the components of various biogeocenoses. *Izvestiya Irkutsk state University. Series: Biology. Ecology*, 13: 16-26. (In Russian)
- Gavrila VAM, Strugariu CE, Oroian T (2016). The phenotypic characterization of wild boar population in Transylvania "Sus Scrofa Ferus". *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Animal Science and Biotechnologies*. 73(1): 27-30.
- Gubin AN, Kaledin AP, Koltsov SS (2019). The population of wild boar in the Tver region. *The international journal of theory and scientific practice*, 2(1): 151-156. (In Russian)
- Hodgkinson SM, Cárcamo A, López I (2011). Selective grazing of *Lolium perenne* and *Plantago lanceolata* by growing European wild boar (*Sus scrofa* L.) in a semi-extensive system. *Livestock Science*. 140: 268-274.
- Holzbauer SM, Agger WA, Hall RL, Johnson GM, Schmitt D (2014). Outbreak of *Trichinella spiralis* Infections Associated With a Wild Boar Hunted at a Game Farm in Iowa. *Clinical Infectious Diseases*. 59 (12): 1750-1756.
- Klevezal GA (2007). Principles and methods for determining the age of mammals. M, t-in scientific publications of the CMC, 234-237. (In Russian)
- Knyazev SP, Shatokhin KS, Goncharenko GM, Frolova VI, Zaporozhets VI, Ermolaev VI, Nikitin SV (2015). Dynamics of live weight growth in small and large forms of domestic pig. *Scientific review*, 6: 9-13. (In Russian)
- Kozlov VV (2018). Organizational and economic aspects of the development of services in the hunting industry. In: *Modern scientific trends in animal husbandry, hunting and ecology*. Collection of articles of the international scientific and practical conference (Kirov, March 12-13, 2018). Kirov, Vyatka state agricultural Academy Publishing house: 286-290. (In Russian)
- Kulpin AA (2008). Features of the biotopic distribution and nutrition of wild boar (*sus scrofa* L.) in the North of the European part of Russia. *Bulletin of the Lobachevsky University of Nizhny Novgorod*, 2: 82-86. (In Russian)
- Lebedko EJ (2006). Determination of the live weight of farm animals by measurements. *Practical guide*. M, LLC «Aquarium-Print», 30-32. (In Russian)
- Linkov AB (2012). Hunting animals: lists and their structuring, identification of potential breeding units, problems and new perspectives of population management. *Bulletin of hunting studies*, 1: 111-120. (In Russian)
- Markov AD, Goldin EB (2016) Management of hunting animal populations in the South-Western Crimea (on the example of wild boar). In: *environmental control Systems. Abstracts of the International scientific and technical conference*. (Sevastopol, October 24-27, 2016). Sevastopol: 163. (In Russian)
- Massolo A, Roberto MdS, Meriggi A (2007). Zoning and wild boar management: a multi-criteria approach to planning. *Hystrix, the Italian Journal of Mammalogy*. 18(1): 57-68.
- Moskvitin SA, Marchenko VN (2007). State of resources of wild ungulates of the Belgorod region and planning of their use in 2006-2007. *Bulletin of hunting studies*, 4(2): 18-20. (In Russian)
- Ninov LK (1979). To the morphology of the skeleton of a wild European boar. *Sat. nauch. Tr. MVA, M., Nauka*, 105: 115-120. (In Russian)
- Ninov LK (1980). Morphofunctional features of the skeleton of wild and domestic pigs. In the book: *Ungulates of the fauna of the USSR: proc. Dokl. M., Nauka*: 33-35. (In Russian)
- Ostapchuk AV (2017). Ecological aspects of breeding wild ungulates in semi-free conditions in the Penza region. In: *Environmental problems and public health. Materials of the II all-Russian scientific and practical conference* (Penza, June 21-22, 2017). Penza, Penza state agrarian University: 41-45. (In Russian)
- Postolache AN, Ciobanu MM, Boișteanu PC (2015). Elected Biometric Characteristics of Wild Boar (*Sus Scrofa* Ferus) in North-East Romania. *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca: Food Science and Technology*. 72(1): 137-138
- Putnin AM (2009). Breeding of wild boars using interbreeding with the Duroc breed. *Bulletin of TSU*, 14. issue. 1: 142-144. (In Russian)

- Revutskaya OL (2014). Quantitative analysis of the impact of human economic activity on the dynamics of the number of hunting animals. *Regional problems*, 17 (2): 18-27. (In Russian)
- Sales J, Kotrba R (2013). Meat from wild boar (*Sus scrofa* L.): A review. *Meat Science*, 94(2): 187-201.
- Shchekalo MV (2018). Wild boar resources (*Sus scrofa* L., 1758) in the Belgorod region: a retrospective and current state. In: *Environmental monitoring and biodiversity. Materials of the all-Russian (with international participation) scientific and practical conference* (ed. Ishim: Publishing house of IPI named after p. p. Yershov (branch) of TSU: 153-156. (In Russian)
- Šiukšcius A, Švirmickas GJ, Razmaitė V (2012) Effect of weight, sex and hunting period on fatty acid composition of intramuscular and subcutaneous fat from wild boar. *Italian Journal of Animal Science*, 11(2): 174-179.
- Suvorov AP, Shirokovskaya EM (2016). Experience of wild boar enclosure keeping in the Krasnoyarsk territory. In: *Science and education: experience, problems, prospects for development. Proceedings of the XIV international scientific and practical conference* (Krasnoyarsk, April 19-21, 2016). Krasnoyarsk, Krasnoyarsk state agrarian University publishing House: 246-250. (In Russian)
- Yamamoto D (2017). *Wild Boar*. Publisher: Reaktion Books, 224 p.
- Zavaleeva SM, Shamraev AV, Godina OV (2018). The influence of external factors on the population of common wild boar, living in territory of the Orenburg region. *Bulletin of modern research*, 10.7 (25): 155-159. (In Russian)
- Ostapchuk AM, Kaledin AP, Wachow DD (2019). On the use of wild boar resources in the Moscow region. *The international journal of theory and scientific practice* 2(1): 160-177. (In Russian)