State of the Manchurian pheasant Phasianus colchicus pallasi population in Russia, its meat productivity and safety

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Abstract: The article states that the Manchu pheasant Phasianus colchicus pallasi is a Far Eastern subspecies of the common pheasant, a common inhabitant of meadows and fields in the coastal region of Russia and in the Amur River valley. Our studies of the Amur pheasant population showed that it has a high abundance of P. c. pallasi in the wild in the Russian Federation. With regard to this type of bird, registration work is regularly carried out. Based on the data of nature conservation inspectors, inspectors of legal hunting, hunting for wild birds is carried out. The problem for modern science is the preservation and development of the gene pool of this species. Further, work to preserve the pheasant in nature and for home and farm poultry farming. Farmed pheasants are mainly a Caucasian subspecies of the common pheasant. Therefore, the main problem is closely related breeding and, as a consequence, the degeneration of birds on farms. They quickly become incapable of reproduction and give rapidly dying offspring. We have considered the Far Eastern population of the common pheasant. As a reservoir of an additional gene pool for enrichment and creation of a stable population of birds for farming and obtaining a primary scientific base for obtaining hybrid breeds. We have studied its number, population dynamics over the years over the past 10 years and food security. Since this estimate is necessary to account for the reserve population of pheasant breeding. Numerous studies of the chemical composition of pheasant meat show that it is richer in protein and lower in fat than broiler meat, the recognized leader in dietary meat. Microbiological studies for food safety have shown its high quality and suitability for nutrition.

1. Introduction

The Manchurian pheasant Phasianus colchicus pallasi (subspecies of the common pheasant) is an inhabitant of meadows, fields, deforestations and sparse forests of the Primorsky Krai and the Amur River valley. Regarding this type of poultry, the survey work is regularly carried out and, on the basis of data presented by inspectors of legal hunting: a catch of birds is carried out according to established limits. An important problem of science is the preservation and development of the gene pool of this species with the further development of the pheasant population for domestic and farm poultry farming. However, in artificially bred pheasants, the main problem is closely related breeding and, as a consequence, the degeneration of the poultry population, their inability to reproduce, and unviable young birds. We considered the Far Eastern population of the common pheasant and its food safety, as
a reserve population for the development of farmer pheasant breeding. Therefore, the purpose of our study was to identify the size and state of the Manchurian pheasant (*Phasianus colchicus pallasi*) population in Russia, to assess its chemical composition and microbiological safety.

2. Material and research methods
The material for the epizootological analysis of the spectrum of infectious and invasive diseases of animals and birds was the data of the final annual reports of the Veterinary Directorate of the Government of the Saratov Oblast, as well as the data of laboratory monitoring conducted by the Reference Center of the Rosselkhoznadzor of the Saratov Oblast and its division, the Interregional Veterinary Laboratory (IVL). Methods of statistical processing of epizootological monitoring data and laboratory research applying radial and linear-graphic schematic models were applied in the work.

We examined the state of the bird population in the habitat areas with territorial division into the Amur Oblast and the Primorye. The results of accounting works were compiled from 20 administrative districts of the Amur Oblast (figure 1). These data were collected on winter route surveys in 2010-2019. Various registration works were carried out in the Primorsky Krai. The first version of the data was collected through aviation surveys [2]. The second variant of the survey information was collected through site counts with a sample of reference sites. The sum of such sites is at least 10% of more or less homogeneous habitat of the species, which was also supplemented by road route surveys.

The study of wild pheasant for avian influenza by Polymerase chain reaction (PCR) was carried out in the Amur Regional Veterinary Laboratory in the period from 2018 to 2020. It also provides information for understanding the dynamics of populations and its epidemiological safety.

We used both live birds and carcasses from farms where birds of two subspecies, *pallasi* and *colchicus* are kept to compare the morphometric data.

Microbiological and physicochemical indicators were studied at the Testing Laboratory Center of VNIIPP according to standardized methods. The test for the microbial safety of meat was carried out by counting the quantity of mesophilic aerobic and facultative anaerobic microorganisms (QMAFAnM) grown on a solid nutrient medium at a temperature of 30±1°C for 72 hours. The quantity of the group of sanitary-indicative microorganisms, i.e. bacteria, yeast, mold fungi, was estimated. Physicochemical studies were carried out: fat - by the method of repeated extraction of fat with a solvent from a dried sample in a Soxhlet extraction apparatus with subsequent removal of the solvent and drying of the separated fat to constant mass; protein – by spectrophotometric method in the measurement range from 1.0% to 40.0% and by the method Kjeldahl in the measurement range from 1.0% to 55.0%, moisture - by the method of frozen sample released during thawing during the time required for melting of all ice crystals inside and on the surface of the sample until the temperature in the thickness of the muscles is not lower than 4°C, mass the proportion of ash - by providing sufficient ash of the dried sample at a temperature of (550 ± 25)°C.

3. Research results
The population of the Manchurian pheasant (*Phasianus colchicus pallasi*) in the Amursk Oblast ranges from 97,097 to 488,090 individuals per 1000 ha [6]. It should be noted that these data are not absolute, there is extrapolation, where the data is slightly distorted, and the unevenness of landscapes and mosaic habitats are not taken into account. These data were corrected by area observed. The averaging density of the pheasant population is 7.51 specimen/1000 ha and the density of the pheasant population from the area of suitable lands, i.e. ecological density is 57.07 specimen/1000 ha in the studied region [1].

According to the peculiarities of the economic development in the region, the sown area for cereals and legumes is increasing [7]. This growth has been typical for the last decade; it gives a noticeable increase in the number of pheasants living here.
From 1741 to 9856 individuals were recorded per 100 km of the route in the Khanka-Razdolenskaya Plain and in the surrounding foothills. The largest number of pheasants on average ranges from 10 to 25 individuals per 100 km of the route in car survey.

![Figure 1. Dynamics of the Manchurian pheasant population according to the data of the Department for the protection, control and regulation of the use of fauna objects and their environment in the Amursk Oblast (2010-2019).](image)

The works of P.V. Fisenko [4] contain data in the autumn-winter period from 2008 to 2011. At that time censuses were carried out to assess short-term seasonal fluctuations in the number on foot routes running in the habitats of the Manchurian pheasant in the Ussuriysk region of the Primorsky Krai, where the pheasant population density is very uneven, from complete absence to 9.96 specimen/km² in some areas.

According to the data in the general information note on the number of pheasants on the territory of the Russian Federation for 2011 [3], a high number of pheasants is characteristic precisely for the regions of the Far East (the Primorsky Krai and the Amursk Oblast, where the Manchurian subspecies lives) (figure 2).

In the western part of the common pheasant habitat, the concentration of birds is in the Krasnodar Krai (North Caucasian subspecies). We assume that in the last decade the statistical data may have acquired different values, but the trend in habitat concentrations could not undergo significant changes. The visualization of bird population density shows a noticeable difference in population that predominates in the eastern part of the range. Therefore, we consider this region as a reservoir for creating a breeder for farmer breeding of this bird.

The species is hunting due to the stable population. The season in the Far East begins on October 15 and ends on December 31 according to the new hunting rules. Pheasant meat is one of the gourmet meat delicacies. Therefore, the pheasant is an attractive prey for hunters. It has managed to win the hearts of breeders, but nowadays those who like to hunt in the wild forests no longer have many opportunities to bring home a shot bird as prey. In many countries of the world, hunting this bird is prohibited. Pheasants are even raised in specialized reserves [17] in order to then release them into their natural habitat and thus preserve the population of the species. Pheasant for meat is grown on farms, but even then, the bird is still semi-wild.
We carried out a comparative assessment of the external morphometric parameters and body weight of birds of two subspecies *Phasianus colchicus* and *Phasianus colchicus colchicus*. The data are presented in Table 1. Individuals *P. c. colchicus* have a compact body and longer wings. The difference in weight and size of females and males of the two subspecies of pheasant is more noticeable in *P. c. colchicus*.

**Table 1.** Comparative assessment of the size and body weight of pheasants (n=10).

| Parameters                                      | *Phasianus colchicus pallasi* | *Phasianus colchicus colchicus* |
|------------------------------------------------|-------------------------------|---------------------------------|
| Males                                          | Females                       | Males                           | Females                       |
| Number of specimens studied, pcs.              | 62                            | 52                              | 87                             | 63                             |
| Average carcass weight with plumage, g         | 1390                          | 1081.5                          | 1450.5                         | 1030.2                         |
| Lim mass of a carcass, g                       | 1090-1690                     | 970-1220                        | 900-2000                       | 710-1350                       |
| Average length of a carcass from the tip of the beak to tail, mm | 827.0                        | 820.3                          | 690.0                          | 567.0                          |
| Lim carcass lengths, mm                        | 760-860                       | 630-850                        | 580-800                       | 456-678                         |
| Average wing length along bone, mm             | 216.2                         | 223.2                          | 253.5                          | 226.1                          |
| Lim wing length, mm                            | 245-260                       | 215-250                        | 228–263                       | 214-236                         |

The results of anatomical gutting are shown in table 2. The weight of the gutted carcass of males, in some cases, exceeded the weight of the carcass of a female pheasant by 38.6%, and the mass of muscles, with a maximum weight, by 30.4%, while the meat yield in females was 1.13 times more than that of males. Table 2 shows data on the anatomical cutting of broiler chickens of the SK Rus 8 cross for comparison.

The output of the pectoral muscles, the most valuable part of the carcass, in male pheasants is 10.5% higher than in broiler chickens, and 8.7% (1.4 and 1.3 times, respectively) higher in female pheasants than in chickens. Also, the output of the thigh muscles in female pheasants was 1.3% (by 1.1 times) higher. In general, the total meat yield in relation to the weight of the cut carcass in males was 2.4% (by 1.04 times) less than that of males, and in females it was 5.8% (by 1.09 times) more...
than chickens. The results of morphological analysis show that the pheasant has very good meat qualities.

**Table 2.** Pheasant carcass weight ratio (n=10).

| Sample                              | Phasianus colchicus          | SK Rus 8         |
|-------------------------------------|------------------------------|-----------------|
|                                     | male | female | male | female | male | female |
| Carcass weight with head and offal, g | 1160 | 791    | -    | -      | -    | -      |
| Gutted carcass weight, g            | 933  | 573    | 1657 | 1464   | -    | -      |
| Boneless breast, g                  | 339  | 217    | 428  | 428    | -    | -      |
| Ratio of the weight of the breast boneless to the weight of the gutted carcass,% | 36.3 | 37.9 | 25.8 | 29.2 | -    | -      |
| Thigh boneless, g                   | 108  | 71     | 192  | 163    | -    | -      |
| Ratio of the weight of the thigh boneless to the weight of the gutted carcass,% | 11.6 | 12.4 | 11.6 | 11.1 | -    | -      |
| Legs boneless, g                    | 62   | 51     | 145  | 113    | -    | -      |
| Ratio of the weight of the shin boneless to the weight of the gutted carcass,% | 6.6% | 8.9% | 8.8  | 7.7    | -    | -      |
| Wings boneless, g                   | 30   | 30     | 77   | 67     | -    | -      |
| Ratio of the weight of the boneless wings to the weight of the gutted carcass,% | 3.2  | 5.2   | 4.7  | 4.6    | -    | -      |
| Back meat, g                        | 23   | 22     | -    | -      | -    | -      |
| Ratio of the mass of meat from the back to the mass of the gutted carcass,% | 2.5  | 3.8   | -    | -      | -    | -      |
| Skin weight, g                      | 21   | 25     | -    | -      | -    | -      |
| The ratio of skin weight to the gutted carcass,% | 2.3  | 4.4   | -    | -      | -    | -      |
| Total weight of the gutted carcass meat, g | 562  | 391   | 1037 | 912    | -    | -      |
| Ratio of the total weight of boneless meat to the weight of the gutted carcasses,% | 60.2% | 68.2% | 62.6% | 62.4% | -    | -      |

Table 3 presents the data of a comparative assessment of the main chemical parameters of carcasses’ meat of the main types of poultry. The information pheasant indices are presented separately for males and females for subspecies *P. c. colchicus*, a sample consisted of 30 wild individuals. The information about other types of poultry is given from [15].

**Table 3.** Main chemical indicators of poultry meat.

| Parameters | Pheasant | Pheasant | Chicken-broilers | Turkeys | Quails | Pintados | Partridges |
|------------|----------|----------|------------------|---------|--------|----------|------------|
| Protein, % | 24.9     | 25.2     | 21.5             | 19.9    | 21.2   | 19.2     | 23.5       |
| Fat, %     | 2.3      | 3.0      | 6.1              | 19.1    | 3.6    | 11.7     | 2.0        |
| Moisture, %| 71.5     | 71.2     | 71.4             | 60.3    | 72.7   | 68       | 72.0       |
| Ash, %     | 1.2      | 1.2      | 0.9              | 1.0     | 1.2    | 1.1      | 1.0        |
| pH         | 5.8      | 5.9      | -                | -       | -      | -        | -          |

The obtained data correlate with the data obtained from other sources [16] for this bird species. The comparison shows that pheasant meat is richer in protein, and fat content is lower only in partridge meat. According to the results one can consider pheasant meat as dietary.
Legal hunting, storage of carcasses, transportation and sale are often carried out in violation of veterinary, sanitary and hygienic requirements. It leads to a decrease in marketable properties, and sometimes damage to valuable products. Data on the meat of wild bird’s quality, the preservation of its original beneficial properties that affect the quality of meat and its nutritional value are extremely insufficient.

4. Legal hunting, storage, transportation and sale

The most important for food safety are dangerous diseases of the highest kind. The list of common pheasant diseases includes non-infectious and infectious diseases. According to the veterinary information, non-infectious diseases are clogged goiter, frostbite, cannibalism, emphysema, cloacitis, gout, trauma [12, 13]. Infectious diseases are pheasant infectious laryngotracheitis, smallpox, pseudoplaque, Marek's disease, ornithosis (psitacosis), respiratory mycoplasmosis, pasteurellosis, colibacillosis, salmonellosis, coccidiosis, botulism, spirochetosis, aspergillopezis, scabby, scabies, and gistostamino [13]. They are typical for all chicken’s diseases. Wild birds, such as pheasant, can be of various infections, including those without clinical signs. Such a bird can transmit the infection when it is healthy, kept in cages and aviaries [8, 9]. It is considered that a bird is a reservoir of Salmonella in nature [10]. Salmonellosis and salmonella carriers are relevant for migratory birds, and the pheasant is a sedentary bird. Mainly, gulls, waterfowl and passerines are carriers of these diseases [11]. The monitoring for avian influenza by PCR was carried out on wild birds obtained during the hunting season under shooting licenses (138 samples), wounded animals obtained from agricultural fields while planting and harvesting (21 samples), as well as on birds seized from poachers by inspectors (149 samples). The studies have not shown a single case of infection with a dangerous viral strain (table 4).

Table 4. Results of PCR monitoring of wild birds of the Manchurian subspecies of common pheasant for avian influenza for 2018-2020.

| Name of the material | Number of samples | Amount of studies (positive) |
|----------------------|-------------------|-----------------------------|
| Internal organs (trachea, intestines) of a pheasant | 76 83 149 | 0 0 0 |

Our studies of the Amur pheasant population showed a fairly safe microbiological state of birds (table 5).

Table 5. Microbiological indicators P. c. Pallasi (n=30).

| Sample  | Coliform bacteria, in 0.0001 g | Salmonella, in 25 g | L. monocytogenes, in 25 g |
|---------|--------------------------------|---------------------|------------------------|
|         | Female | Male | Female | Male | Female | Male | Female | Male |
| Breast  | 20     | < 10  | none   | none | none   | none | none   | none |
| Legs    | 60     | 100   | none   | none | none   | none | none   | none |
| Intestines | -     | -     | none   | none | none   | none | none   | none |

Thus, our studies of the Amur pheasant population showed the high abundance of P. p. pallasi in the wild on the territory of the Russian Federation. This pheasant subspecies can be used to create breeders for farming.

Numerous studies of the chemical composition of pheasant meat show that it is richer in protein and lower in fat than meat from broiler chicken, a recognized leader in dietary meat.
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