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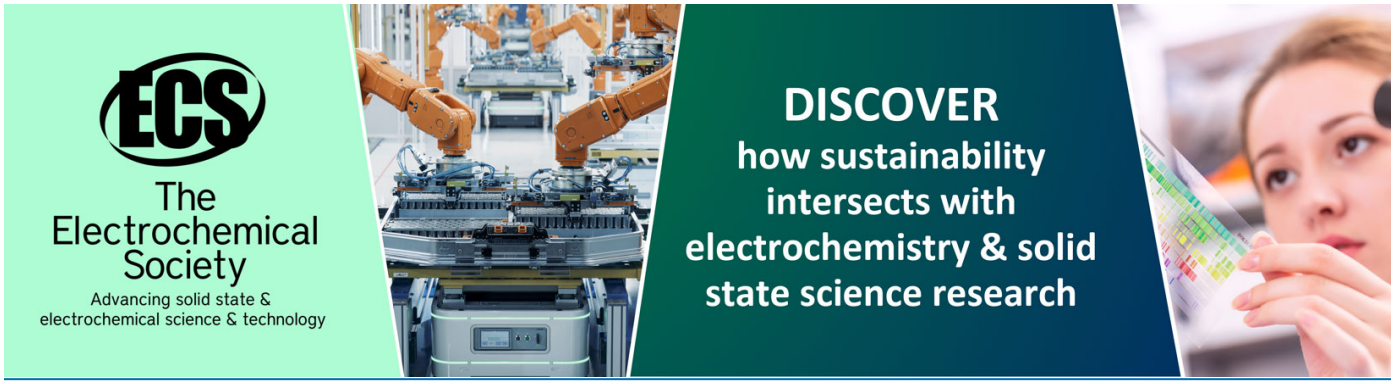

Microbiological Control of Muscle Tissue and By-Products of Grouse on the Territory of the Republic of Sakha (Yakutia)

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Abstract. This work is devoted to the microbiological analysis of meat and by-products of hazel grouse in the conditions of the Republic of Sakha (Yakutia), depending on the seasons. The material for the study was the carcasses and internal organs of hazel grouses, obtained in hunting brigades and hunters during the spring-autumn shooting of birds in the Republic of Sakha (Yakutia). Samples of muscle tissue, lungs, heart, liver, kidneys, the contents of the stomach and intestines of hazel grouses were taken from 29 birds for the isolation of *E.coli*, salmonella, staphylococci and *Cl. perfringens*. According to the research results, it was found that the intensity of bacterial contamination depends on the season, that the greatest contamination of E. coli, salmonella, staphylococci occurs in the spring, made it possible to determine the species composition of the microflora of the organs and tissues of hazel grouse by the seasons of the year.

1. Introduction

The grouse is a nesting sedentary bird from the Grouse family, has a mass of 305-560 g. The overall plumage tone of the female and male is gray with black and transverse stripes on the upper part of the body. The beak is grayish black. The bird is an inhabitant of the entire taiga zone of Yakutia. The summer-autumn period it feeds on invertebrates, seeds of grasses and shrubs, berries. Spring-winter period it feeds on aglets and buds of birch and alder [14, 20].

Figure 1. Grouse (*Bonasa bonasia (Linnaeus, 1758)* www.hunting.ru [3].

Grouse meat is very tender with a specific smell and taste. The fat is white or slightly yellowish in color. The muscle tissue is white with a pinkish tinge, thin-fibrous, without visible layers of connective tissue [16].

2. Relevance

The meat of wild fishing birds, in particular the meat of grouse birds, is considered a delicacy and protein product, therefore it plays an essential role for survival in the extreme conditions of the North, where hunting is one of the main economic activities of the population [18]. It should also be noted that the composition of the muscle tissue of game birds has a high iron content (5.45-5.65 versus 2.16 mg in chickens), in particular in hazel grouse [17].

According to the Data of the Report on Winter Route Census (WR) of hunting animals in the Republic of Sakha (Yakutia) [12] in 2015, the number of hazel grouses was 1,428,152 individuals (see Tab. 1). The main number of hazel grouses was concentrated in the southwestern part of Yakutia, where the density of its species population in some places reached 40 individuals / km².

Table 1. The number of hazel grouses on the territory of the Republic of Sakha (Yakutia) in 2015 [12].

Administrative zone	Route length, km			Number of birds (individuals), pcs		
	forest	open.	total	forest	open.	total
Tundra	1687,5	770,4	2457,9	0	0	0
Northwest	9621,4	1779,4	11400,8	80797	0	80 797
Northeastern	9450,7	2217,4	11668	0	0	0
Kolymo-Indigirskaya	13164,4	3192,4	16356,8	11 928	0	11 928
Vilyuiskaya	10398,3	1551,6	11949,9	101209	3909	105 118
Central	12290,6	3035,6	15326,2	130837	4673	135 510
Southwest	7964	179,8	8143,8	346846	0	346 846
Total for RofS (Y)	**82870,1**	**13650,1**	**96520,2**	**1405815**	**22337**	**1 428 152**

Responding to increasing demand for grouse meat on the domestic market of the Republic of Sakha (Yakutia), it was necessary to assess their safety.

The sanitary condition of meat and its good quality are judged by the degree of its microbial contamination. Microbial contamination of meat predetermines relatively rapid deterioration and, most importantly, creates a risk of food toxicoinfections and toxicoses in humans [1,15,18].

The degree of microbial coverage of the internal organs and grouse meat during its extraction is of practical interest.

The purpose of this study is to study microbiological contamination and determine their species of carcasses and by-products of hazel grouse, depending on the period of the year.

To achieve the goal, the following tasks were set:

1. To establish the degree of microbial contamination of hazel grouses of different periods of extraction;

2. Determine the species composition of the microflora of meat and internal organs of hazel grouse.

3. Materials and methods of research

The work was performed in the period from 2016 to 2021, includes field and laboratory studies. Field studies were carried out on the territory of the Republic of Sakha (Yakutia). Laboratory studies were carried out at the Department of Veterinary and Sanitary Expertise and Hygiene of the Faculty of Veterinary Medicine of the Arctic State Agrotechnological University.

The material for the study was the carcasses of hazel grouses, caught in hunting brigades and hunters during the spring-autumn shooting of birds in the tundra reservoirs of the Arctic Circle of the Far North, as well as along the valleys of the Vilyuya and Lena rivers (Vilyui zone), southern and northern zones of the Republic of Sakha (Yakutia).

The carcasses of hazel grouses were subjected to microbiological research immediately after shooting in the spring and autumn periods of the year. Samples of muscle tissue, lungs, heart, liver, kidneys, the contents of the stomach and intestines of hazel grouses were taken from 29 birds for the isolation of *E.coli*, salmonella, staphylococci and *Cl. perfringens*.

Microbiological indicators were determined according to the following regulatory documents: TR CU 021/2011; Sampling techniques for microbiological research was carried out according to GOST R 50396.0-92 "Poultry meat, co-products and poultry products. Sampling techniques and preparation for microbiological research"; GOST R 51448-99 "Meat and meat products. Sampling techniques for microbiological research"; GOST 26668-85 "Food and flavoring products. Sampling methods for microbiological analyses"; "Instructions for sanitary and microbiological control of carcasses, poultry meat, poultry products, eggs and egg products at poultry and poultry processing enterprises" (1990). The total microbial contamination was determined according to GOST R 53665-2009 "Poultry meat, co-products and semi-processed poultry meat. Method of identification of salmonella" [2, 4, 9, 10, 11, 5, 6, 7, 8, 16].

4. Research results

For the first time in the conditions of the Republic of Sakha (Yakutia), the microbiological indicators of carcasses and by-products of hazel grouse were studied on the basis of microbiological studies.

Based on the results of the research methodological instructions "Microbiological control of upland game meat" were published for students of the faculty of veterinary medicine of the Federal State Budgetary Educational Institution of Higher Education " Arctic State Agrotechnological University " in the direction of training 03.03.01 Veterinary and sanitary examination, 06.03.01 Biology, 36.04.01 Veterinary and sanitary examination, 36.05. 01 Veterinary.

Microbiological research of the muscle tissue and internal organs of grouse in the spring and winter periods are presented in Table 2.

Esherichia coli was discovered in the spring in the intestinal mucosa - 17.24%, in the liver - 14.28%, in the stomach - 13.79% of cases. Autumn period in the intestinal mucosa - 6.9%, in the stomach - 3.45%, in the liver - 3.57%, in the kidneys - 7.41%, in the muscle tissue - 6.9%, in the heart - 3.4%.

Bacteria of the genus *Salmonella* were isolated in the autumn from the intestinal mucosa - 6.9%, in the liver - 3.45%. Spring: intestinal mucosa - 10.34%, liver - 7.14%, muscle tissue - 3.57%, kidneys - 3.7% and stomach - 3.45%.

Staphylococcus aureus in the autumn was detected only in the intestinal mucosa in 6.8%. In the spring, in the intestinal mucosa and lungs - 6.8% and 3.4%, respectively.

Cl.perfringens in the spring was isolated in the liver - 3.45%, in the intestinal mucosa - 6.9%.

Table 2. Seeding of the muscle tissue and internal organs of grouse in the spring and autumn periods, %

Research	*E.coli*						*Salmonella*						*Staphylococcus aureus*						*Cl. perfringens*					
	Spring			Autumn			Spring			Autumn			Spring			Autumn			Spring			Autumn		
	Number of samples	Number of positive	% of detection	Number of samples	Number of positive	% of detection	Number of samples	Number of positive	% of detection	Number of samples	Number of positive	% of detection	Number of samples	Number of positive	% of detection	Number of samples	Number of positive	% of detection	Number of samples	Number of positive	% of detection	Number of samples	Number of positive	% of detection
1. Muscle tissue	29	2	6,90	29	-	-	29	1	3,57	29	-	-	29	-	-	29	-	-	29	-	-	29	-	-
2. Liver	28	4	14,28	28	1	3,57	28	2	7,14	28	1	3,57	28	-	-	28	-	-	28	1	3,55	28	-	-
3. The heart	29	1	3,4	29	-	-	29	-	-	29	-	-	29	-	-	29	-	-	29	-	-	29	-	-
4. The lungs	29	-	-	29	-	-	29	-	-	29	-	-	29	1	3,45	29	-	-	29	-	-	29	-	-
5. Kidneys	27	2	7,41	27	-	-	27	1	3,7	27	-	-	27	-	-	27	-	-	27	1	-	27	-	-
6. Stomach contents	29	4	13,79	29	1	3,45	29	1	3,45	29	-	-	29	-	-	29	-	-	29	-	-	29	-	-
7. Intestinal mucosa	29	5	17,24	29	2	6,90	29	3	10,34	29	2	6,9	29	2	6,90	29	1	6,90	29	1	3,45	29	-	-

Table 3. Species of pathogenic microorganisms isolated in the muscle tissue and internal organs of grouse in the spring and autumn.

Indicators	Muscle tissue		Liver		The heart		The lungs		Kidneys		Stomach contents		Intestinal mucosa	
	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring
Number of samples	29	29	28	28	29	29	29	29	27	27	29	29	29	29
Sampled with *E.coli*	2	-	4	1	1	-	-	-	2	-	4	1	5	2
Including serogroup 018	1	-	-	-	-	-	-	-	-	-	1	-	-	-
026	1		1	-	1	-	-	-	-	-	-	-	1	1
044	-	-	1	1	-	-	-	-	1	-	1	-	1	1

078	-	-	1	-	-	-	-	-	1	-	1	1	1	-
088	-	-	1	-	-	-	-	-	-	-	-	-	1	-
0124	-	-	-	-	-	-	-	-	-	-	1	-	-	-
0127	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Sampled with salmonella	1	-	2	1	-	-	-	-	1	-	1	-	3	1
S.gallinarum	-	-		-	-	-	-	-	-	-	-	-	-	-
S.pullorum	1	-	1	-	-	-	-	-	-	-	1	-	1	-
Sampled with staphylococci	-	-	-	-	-	-	-	-	-	-	2	-	1	-
Sampled with *St.aureus*	-	-	-	-	-	-	-	-	-	-	1	-	1	-
St. Album	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Sampled with *Cl.perfringens*	-	-	1	-	-	-	-	-	1	-	-	-	1	-

5. Conclusion

Analysis of the results of the work performed, in particular, microbial contamination of organs and tissues of upland game in the conditions of the Republic of Sakha (Yakutia), made it possible to determine the species composition of the microflora of organs and tissues of hazel grouse by seasons.

Thus, bacteria of the Escherichia coli group, Salmonella, staphylococci and *Cl.perfringens* were isolated from internal organs and muscle tissue.

In that way, as a result of microbiological studies of the muscle tissue and internal organs of the upland game of Yakutia, it has been established that the intensity of their bacterial contamination depends on the season. Thus, the most seeded bacteria are *E.coli*, *Salmonella*, *Staphylococcus aureus* and *Cl.perfringens* in autumn. The intensity of infection decreases in spring, at which time the birds feed on birch buds, small branches of larch, which have bactericidal properties.

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