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Basics of rabies prevention in the Republic of Belarus (review)

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ABSTRACT

Introduction. Rabies remains one of the most dangerous zoonotic diseases. The Republic of Belarus is affected by animal rabies and the disease is reported in all regions of the country.

Objective. The work was aimed at assessment of rabies situation in the Republic and summarizing up-to-date approaches to the disease diagnosis and prevention.

Results. Current data on rabies situation in animals and humans in the Republic of Belarus are presented. In the Republic of Belarus, rabies is commonly reported in wildlife and both the country territory and its neighbouring countries (Poland, Lithuania, Latvia, Ukraine, Russia). Wild carnivores, foxes, raccoon dogs and wolves are the main reservoir of rabies virus (70% of all reported cases). Domestic carnivores (cats, dogs) are the second rabies reservoir, and sporadic rabies cases are also reported in livestock animals. The main activities of the Veterinary and Sanitary-Epidemiological Service of the Republic of Belarus, including specific rabies prevention in domestic carnivores, oral rabies vaccination of wild carnivores and public awareness campaigns are described in the paper, historical and modern data on the vaccination and its effectiveness, main strategies laid down in the Comprehensive Rabies Prevention Plan for 2021–2025 as well as data on the effectiveness of the specific activities included in the plan are presented.

Conclusion. In the Republic of Belarus, rabies remains a significant concern, particularly in wild animals. Key rabies control measures primarily involve the oral vaccination of wild animals and public awareness campaigns. To achieve a sustained reduction in rabies cases in wild and domestic animals and to minimize human exposure risks, the areas of wildlife oral vaccination shall be expanded, domestic carnivore vaccination programs shall be intensified and their control shall be enhanced.

Keywords: review, Republic of Belarus, rabies, domestic and wild animals, prevention, oral vaccination

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Основы профилактики бешенства в Республике Беларусь (обзор)

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ABSTRACT

Введение. На современном этапе бешенство продолжает оставаться одним из самых опасных инфекционных заболеваний зоонозной природы. Республика Беларусь является неблагополучной по бешенству животных, при этом заболевание регистрируется во всех регионах страны.

Цель исследования. Целью работы являлись оценка эпизоотической ситуации по бешенству в республике и обобщение современных подходов к диагностике и профилактике заболевания.

Результаты. Приведены актуальные данные об эпизоотической и эпидемиологической ситуации по бешенству в Республике Беларусь. Бешенство на территории республики протекает в виде эпизоотии природного типа, в которую она была вовлечена совместно с граничащими государствами (Польша, Литва, Латвия, Украина, Россия). Чаще всего резервуаром вируса бешенства являются дикие плотоядные животные (70% от всех зарегистрированных случаев): лисы, енотовидные собаки и волки. На втором месте – домашние плотоядные (кошки, собаки), в единичных случаях –

сельскохозяйственные животные. В статье описаны основные направления работы ветеринарной и санитарно-эпидемиологической службы Республики Беларусь, включая специфическую профилактику бешенства среди домашних плотоядных животных, оральную антирабическую вакцинацию диких плотоядных животных и информационную работу с населением, приводятся исторические и современные данные о вакцинации и ее эффективности, представлены основные стратегические направления Комплексного плана профилактики бешенства на 2021–2025 гг., приведены данные об эффективности отдельных мероприятий плана.

Заключение. В Республике Беларусь проблема бешенства остается актуальной, в первую очередь она касается дикой фауны. Основополагающими методами борьбы с заболеванием являются оральная антирабическая вакцинация диких животных и информационная работа с населением. Для стойкого уменьшения количества случаев бешенства в дикой и домашней фауне, а также для снижения рисков заболевания людей считаем необходимым дальнейшее расширение площадей оральной антирабической вакцинации, а также усиление контроля и интенсивности программы антирабической вакцинации домашних плотоядных животных.

Ключевые слова: обзор, Республика Беларусь, бешенство, домашние и дикие животные, профилактика, оральная вакцинация

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INTRODUCTION

The Republic of Belarus is a country affected by animal rabies, the disease is reported in all its regions. In the Republic of Belarus, rabies is commonly reported in wildlife and affects both the country territory and territories of its neighbours (Poland, Lithuania, Latvia, Ukraine, Russia) [1, 2, 3, 4, 5, 6].

The main reservoir of the rabies virus is wild carnivores, 70% of all reported cases. Among them, foxes are primary carriers. Raccoon dogs and wolves are also involved in the epizooty; their high population densities are supported by favourable environmental conditions for these species. Domestic carnivores (cats, dogs) are the second rabies reservoir; sporadic rabies cases are also reported in livestock animals. However, despite the fact that rabies cases are reported in animals annually, no rabies cases have been reported in humans since 2012 [3, 7, 8, 9, 10].

For the purpose of rabies prevention, mandatory anti-rabies vaccination of domestic carnivores (cats and dogs) and livestock animals is annually carried out in rabies-affected localities in Belarus. Persons at high-risk occupations for rabies exposure – including veterinarians, animal control officers, foresters, gamekeepers, and hunters – also receive pre-exposure rabies vaccination [9, 11, 12, 13, 14].

The ongoing oral immunization of wild carnivores, implemented since 2004, has significantly improved the rabies situation in the Republic of Belarus. It should be noted that chicken heads, into which the vaccine was directly injected, were used for the first vaccination programs. In 2007–2010, vaccination of wild carnivores was carried out throughout the country, and in 2010, the country's veterinary service decided to centralize the vaccination efforts and the baits containing the vaccine in a blister were developed and put into practice.

Since 2011, vaccination has been carried out along the border of the Republic of Belarus with Lithuania, and since 2012 – with Latvia and Poland.

In 2014, the number of animal rabies cases in the country decreased. In 2015 the number of animal rabies cases increased due to the rabies cases detected in uncultivated territories of the Gomel Oblast (230 cases) and Mogilev Oblast (138 cases). In 2016, the number of animal rabies cases decreased again, but in 2017–2018 there was an increase in rabies incidence, 539 cases were reported in 2019, and 752 cases were reported in 2020. The largest number of rabies cases was reported in the Mogilev (199), Minsk (177) and Gomel (168) Oblasts. A total of 123 rabies cases were reported in the Vitebsk Oblast, 52 rabies cases were reported in the Brest Oblast. The lowest number of rabies cases (33) was reported in the Grodno Oblast. Analysis of the data clearly indicates the dependence of the number of infected animals in different oblasts of Belarus on the performed/non-performed oral vaccination of wild carnivores [9, 11, 12]. In the Republic of Belarus, the oral vaccination is targeted and limited. Over the past two years, oral vaccination of wild carnivores has not been carried out in the Gomel and Mogilev Oblasts, which have traditionally been leaders in the number of reported animal rabies cases in recent years (for example, in 2020 there was a twofold increase compared to the previous year, followed by a gradual decline). Vaccination of wild animals in the Grodno Oblast, including vaccination performed within the transboundary collaborative actions, resulted in 2.8 fold-decrease in animal rabies cases in the Oblast in 2020 as compared to the previous year, and the number of infected animals was practically reduced to zero by the reporting year 2024 [9, 10].

A total of 2.75 million vaccine baits are distributed annually (1,377 thousands baits in spring and 1,377 thousands baits in autumn) in the Grodno Oblasts, as well as in

Table
Dynamics of rabies incidence in the regions where oral rabies vaccination is carried out

Region	2020	2024
Brest Oblast	52 (39 wild + 13 dom.)	9 (8 wild + 1 dom.)
Vitebsk Oblast	123 (73 wild + 50 dom.)	28 (20 wild + 8 dom.)
Grodno Oblast	33 (25 wild + 8 dom.)	1 wild

wild – wild animals, dom. – domestic animals.

the areas of the Brest and Vitebsk Oblasts bordering the EU countries (about 56 thousand km²). It should be noted that there is a steady trend towards a decrease in rabies cases in wildlife, owing to, among other things, the annually expanding area of oral vaccination of wild carnivores. Thus, reported data shows a 4-fold decrease in rabies cases in the Brest and Vitebsk Oblasts and a 30-fold decrease in the Grodno Oblast for the past five years (2020–2024). In the latter, the disease has been nearly eliminated (Table).

Therewith, in the oblasts where oral vaccination was not carried out (Minsk and Mogilev Oblasts) or was performed manually with minimal bait distribution in some areas (Gomel Oblast), the number of rabies cases was significantly higher in 2024. This was particularly evident in the city of Minsk and Minsk Oblast and Mogilev Oblast, where 75 and 49 cases were reported, respectively.

To achieve full coverage of the country's territory the area of aerial wild carnivore vaccination must be expanded to 129,000 km². For the Republic of Belarus, the estimated vaccination coverage area is 185,000 km² where 8.52 million baits are to be distributed annually – 4.26 million baits in spring and 4.26 million baits in autumn – at a distribution density of (24 ± 1) baits per km². It should be noted that the Republic authorities pay special attention to the ongoing monitoring and assessment of oral vaccination effectiveness in wild carnivores, which is critical for making evidence-based decisions on the vaccination program continuation, modification, or cessation.

The comprehensive scheme (program) for assessment of oral rabies vaccination effectiveness in wild carnivores includes the following key points.

1. Estimation of the vaccination coverage (the area where the oral rabies vaccination of wild carnivores is carried out).
2. Registration of oral rabies vaccination duration and continuity in wild carnivores.
3. Selection of target (sentinel) animal species for assessing the effectiveness of oral rabies vaccination of wild carnivores.
4. Assessment of the vaccines used for oral rabies vaccination for their effectiveness and safety.
5. Calculation of optimal of rabies vaccine bait placement (pattern and quantity) in wild carnivore habitats.
6. Monitoring for evaluation of the oral rabies vaccination results in wild carnivores.
7. Making adjustments to the oral vaccination pro-

gram, if necessary, based on the monitoring results.

The State Veterinary Service is responsible for organizing the effectiveness assessment, which includes the following tasks:

- determination of the sampling size and sampling areas for monitoring purposes;
- determination of the funding source and designation of the testing laboratory;
- determination of the sampling procedure: persons involved in the shooting of animals, the place of sample storage, procedure for sample transportation to the testing laboratory.

The laboratory tests are aimed at:

- assessment of the level of animal protection based on the presence of anti-rabies virus antibodies;
- assessment of the vaccine bait uptake by identifying (counting) the animals containing the tetracycline marker in bone tissue (jaw bone and teeth);
- estimation of morbidity (number of diseased animals detected during monitoring and number of rabies cases detected during the year).

Based on the assessment and the above tasks fulfillment outcomes conclusions on the vaccination quality and on need for its correction or cessation are made.

During the development of oral vaccination programs, target animal species, being the main disease vectors in a particular territory, are identified and further used as sentinels during oral vaccination monitoring. In the Republic of Belarus, these are foxes, wolves and raccoon dogs.

The following sampling size for oral vaccination monitoring was determined: 4 animals per 100 km² per year, i.e. 2 animals per spring and autumn campaign (according to the resolution “Towards the elimination of Rabies in Eurasia”, May 27–30, 2007), providing that principle of sample uniformity (homogeneity) is met [15].

Non-representative sampling repeated annually alongside the lack of serological monitoring for antibodies may obstruct a comprehensive evaluation of oral vaccination effectiveness. This data gap compromises the ability to make evidence-based decisions regarding the expansion or reduction of vaccination areas. It can also lead to an erroneous conclusion on rabies eradication in the area upon the oral vaccination program completion.

The Department of Veterinary and Food Supervision of the Ministry of Agriculture and Food of the Republic of Belarus designated the Medical and Diagnostic

Institution “Vitebsk Oblast Veterinary Laboratory” [9] accredited according to GOST ISO/IEC 17025-2019¹ to perform laboratory monitoring of the oral vaccination effectiveness based on the following parameters:

- detection of antibodies to rabies virus in sera, blood plasma or biological fluids by enzyme-linked immunosorbent assay (ELISA);
- detection of a biomarker (tetracycline) in wild carnivore teeth;
- detection of the antigen – antibody complex by fluorescent antibody test (FAT).

For quality assurance purpose, the MDI “Vitebsk Oblast Veterinary Laboratory” took part in international comparative tests using the following parameters in 2021:

- detection of antibodies against rabies virus in carnivorous sera in the framework of proficiency testing program (provided by VETQAS, Animal & Plant Health Agency, Great Britain);
- detection of a marker (tetracycline) in carnivore teeth/jaws (organized by the Federal Centre for Animal Health, Russia).

Laboratory tests for rabies diagnosis are carried out in accordance with the regulatory documentation: GOST 26075-2013²; Methodical guidelines for the detection of antibodies to rabies virus with ELISA in sera, blood plasma or biological fluids³ and for the detection of a marker (tetracycline) in wild carnivore teeth⁴.

When monitoring oral vaccination effectiveness, ensuring the quality of the samples collected for laboratory testing is crucial. The samples are collected jointly by the Veterinary Service and hunting farms (e.g., hunters, rangers) or environmental protection agencies (e.g., foresters) representatives. Jaw sections with canines and incisors as well as biological fluids of the animal (blood, transudate, thoracic fluid) are collected for laboratory tests.

The oral rabies vaccine uptake is determined by the fluorescent method: a marker (tetracycline) contained in baits is detected in teeth and mandibular bone tissue. Test materials (lower jaw with canines and incisors) are stored and transported in frozen state.

The age is taken into account when bait uptake is determined. Because the tetracycline marker is permanent, it is not possible to ascertain when the bait was consumed. Therefore, the proportion of tetracycline-positive results is usually higher in adults than in young animals. To evaluate the outcomes of the latest vaccination round, a cohort of young animals should be selected. However, age assessment is often neglected since young animals constitute a significant proportion of the population.

The level of animal protection (seroprevalence) is assessed by determination of virus neutralizing antibody levels (IU/mL). It should be taken into account that 0.5 IU/mL is considered to be the level of antibodies (determined by virus neutralization test) that reliably protects against infection with rabies virus. For rabies eradication, the proportion of protected animals (target species) in the population should be at least 70%. This level of protection prevents infection, even after contact between a rabid animal and vaccinated animals. When the virus transmission rate falls below one, the epizootic subsides. Maintaining a high and uniform level of animal protection in a vaccinated area is crucial because low-immunity pockets can serve as persistent reservoirs for natural infection. This can facilitate the spread of disease to other regions after oral vaccination program cessation.

The quality of biological samples collected for laboratory diagnosis is of great importance. The main biological sample to be collected for tests for rabies is the animal brain, its most important parts: medulla oblongata and cerebellum as well as Ammon's horn and cerebral cortex.

For optimal preservation, biological samples shall be stored frozen or chilled. Preservation in buffered saline supplemented with 10% formalin is acceptable only in extreme cases. It is critical to note that this latter method affects the test result quality, making virus isolation impossible. Preservation in buffered saline solution supplemented with glycerine (50%) is also allowed, however, this method also produces lower-quality results [16, 17].

The MDI “Vitebsk Oblast Veterinary Laboratory” carries out the following tests: fluorescent antibody test, mouse inoculation test (bioassay), ELISA and neutralization test.

Fluorescent antibody test (other names: immunofluorescence assay (IFA), direct fluorescent antibody test (dFAT) offers the following advantages being rapid (providing results within 2–3 hours), highly sensitive and specific, relatively cheap. Disadvantages of the FAT include the lack of instrumental recording, which introduces subjectivity in result interpretation.

The mouse inoculation test (bioassay) demonstrates high sensitivity and specificity when performed on fresh, non-decomposed samples. However, this method has several significant disadvantages: it is a prolonged procedure, requiring up to 30 days to complete; it is costly; and its sensitivity drastically decreases with putrefied samples leading to false-negative results. Furthermore, the technique poses an increased biohazard risk to the operator due to handling infected animals and syringe as well as a potential risk to the environment. It also faces growing ethical concerns and public opposition to the use of tests in animals. It should be noted that bioassay for rabies detects only infectious (active) virus. Therefore, if a pathogen has been inactivated, a bioassay might show a negative result (no live virus) even with positive antigen or genome detection, because the components of the virus are still present but the virus itself is not active. In addition, if the biomaterial has

¹ <https://nil39.ru/docs/GOST-17025.pdf> (in Russ.)

² <https://docs.cntd.ru/document/1200104625> (in Russ.)

³ Methodical guidelines for the detection of antibodies to rabies virus with ELISA in sera, blood plasma or biological fluids: approved by the MDI “Vitebsk Oblast Veterinary Laboratory” on 12 May 2021. (in Russ.)

⁴ Methodological guidelines. Detection of a marker (tetracycline) in wild carnivore teeth: approved by the MDI “Vitebsk Oblast Veterinary Laboratory” on 11 June 2021. (in Russ.)

a toxic effect, it is impossible to obtain a result. Mouse deaths are confirmed as rabies-specific using the FAT.

The enzyme-linked immunosorbent assay (ELISA) designed for virus antigen detection provides significant advantages, including high specificity, a high-throughput capacity for processing numerous samples quickly, and a simple test procedure, instrumental recording of the results; undiminished sensitivity when testing non-fresh (decomposed) pathological samples. But at the same time, ELISA demonstrates lower sensitivity when used for testing fresh pathological samples compared to FAT. However, the World Organisation for Animal Health (WOAH) recommends that ELISA, due to its often lower sensitivity compared to gold-standard methods, be used for rabies diagnosis only when followed by confirmatory testing.

Virus neutralization test – VNT (such as rapid fluorescent focus inhibition test – RFFIT) is used for testing anti-rabies immunity level for the purpose of assessment of oral vaccination effectiveness. The principal advantage of the VNT is its ability to precisely quantify virus-neutralizing antibodies, a key feature that establishes it as the diagnostic “gold standard”. However, the VNT has several disadvantages. These include a prolonged procedure lasting several days, stringent requirements for operators’ qualifications and experience, cell culture maintenance, high operational costs. Furthermore, the test can be compromised by the toxic effects of certain samples on the cell monolayer and necessitates the use of fixed rabies virus.

When assessing rabies occurrence in wildlife, it is essential to recognize that monitoring and epizootological surveillance are interdependent and serve as key components of successful oral vaccination programs. A decrease in reported rabies cases is a key indicator of successful oral vaccination programs (provided that ongoing passive surveillance is carried out and laboratory testing of suspected animals is performed).

A decision on oral rabies vaccination cessation is made when no rabies cases have been reported for at least two years.

The rabies situation in the country requires the constant and vigilant attention of the Sanitary and Epidemiological Service of the Ministry of Health of the Republic of Belarus [10, 13, 18]. A change in the epizootic pattern increases human exposure to rabid animals, including mass exposure events (more than 5 injured persons), thereby raising the risk of rabies in the human population. Annually, approximately 18,000 to 20,000 people receive post-exposure prophylaxis for rabies following contact with animals. Of these, 400 to 700 human cases involve confirmed exposure to rabid animals. In 2024, the largest number of post-exposure treatments was reported in the Minsk and Mogilev Oblasts, while the minimum number of post-exposure treatments was registered in the Grodno Oblast [10, 18, 19, 20].

Control of natural rabies reservoirs, primarily through the mass oral vaccination of wild carnivores, is the most effective strategy for ensuring public safety. This approach is essential given the rising number of animal rabies cases and the central role wild carnivores play as the main reservoir of the virus.

Successful rabies prevention requires constant and coordinated actions taken by the concerned ministries and departments, executive authorities, and research institutions. Only an interdepartmental approach can successfully combine the efforts of these organizations. This strategy served as the basis for the Comprehensive Rabies Prevention Action Plan (hereinafter referred to as the Comprehensive Action Plan) in the Republic of Belarus (2021–2025)⁵. The Plan was approved in 2021 (No. 06/204-211/321). One of its main tasks was to organize the vaccination of wild carnivores against rabies.

The Comprehensive Action Plan goal is to prevent rabies in both wild and domestic animals, as well as to ensure epidemiological and public health safety, to prevent human rabies by drastically reducing natural rabies cases through vaccination of wild carnivores; to carry out specific anti-rabies preventive measures in pets and livestock animals; to reduce human exposures to rabies following the contact with animals, including rabid animals, that will ultimately reduce the number of persons receiving rabies post-exposure treatment.

According to the Comprehensive Action Plan, responsible authorities (Ministry of Agriculture and Food, Ministry of Health, Ministry of Nature, Ministry of Forestry, Ministry of Housing and Communal Services, executive committees in oblasts and raions of the Republic of Belarus) shall carry out relevant measures, the main of which are the following:

- censusing of wild carnivores including foxes, raccoon dogs, wolves: number of animals per km² of hunting grounds;
- monitoring of rabies situation in the world including rabies situation in border areas;
- mapping of wild carnivore density in hunting grounds;
- procurement of blister vaccine baits for oral immunization of wild carnivores taking into account the bait distribution area;
- briefing for persons involved in oral vaccination of wild carnivores;
- aerial distribution of blister vaccine baits across the target vaccination zone and recording the bait release coordinates;
- control shooting of wild carnivores being natural rabies reservoirs in the target zone, at least 2 animals per 100 km² of hunting grounds and delivery of samples to the diagnostic departments of regional veterinary stations (taking into account the population size);
- sampling and delivery of pathological samples (jaws and blood) collected from the animals shot within the vaccine quality monitoring and control to the laboratories;
- laboratory tests of the samples (blood – for antibodies, jaws – for markers) collected from the shot animals;
- collection and delivery of biological samples (brains of dead rabies suspects) for laboratory testing to monitor and record animal rabies cases;
- laboratory tests of brain samples from dead rabies suspects for animal rabies case monitoring and recording;

⁵ https://s3-minsk.cloud.mts.by/datastorage/belitsa/library/321_Plan_for_rabies_prevention.pdf (in Russ.)

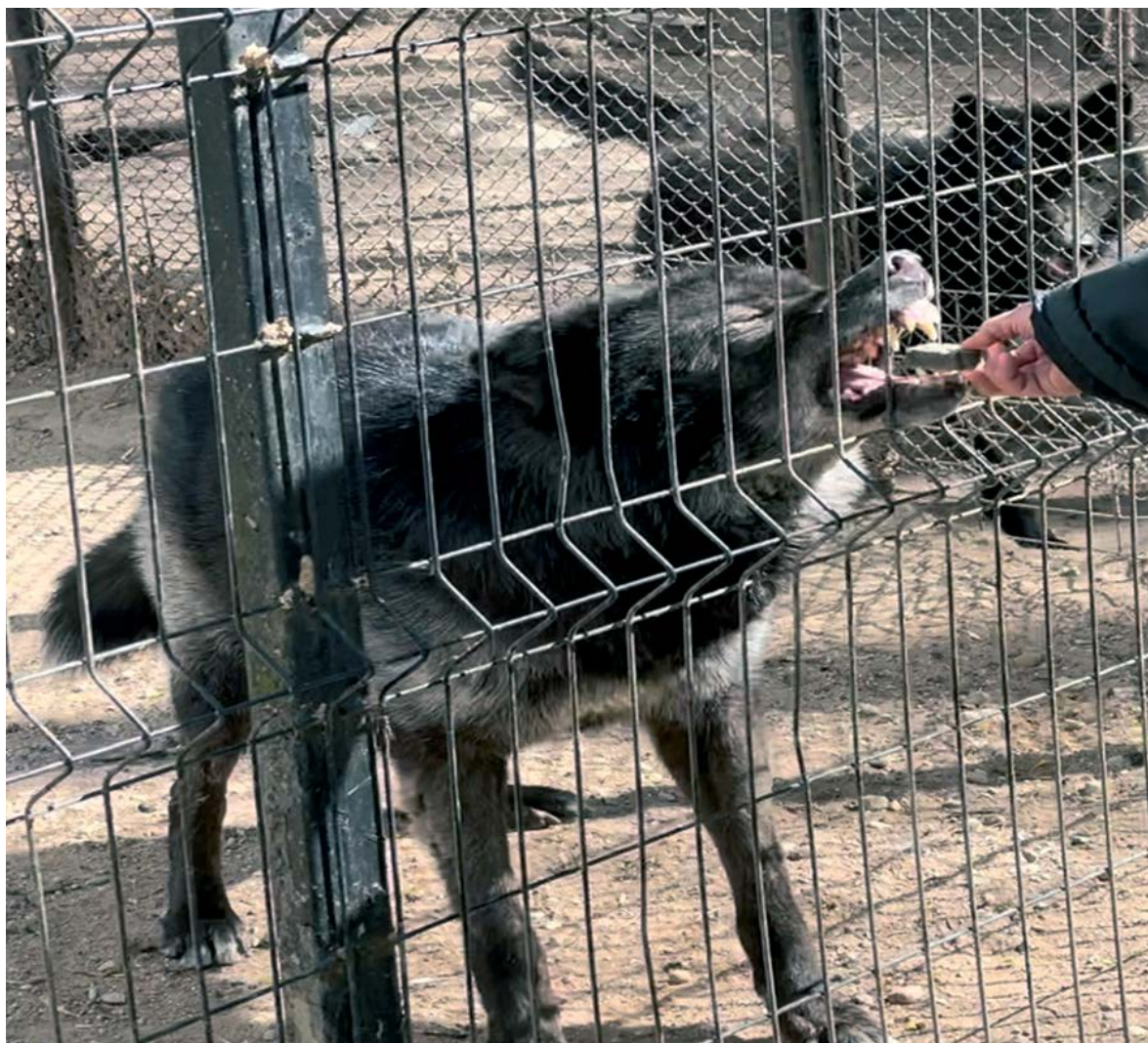


Fig. 1. Feeding oral immunization baits to wolves

- capture of stray dogs and cats in residential areas;
- measures taken to prevent the incursion of wild and stray animals on organizational facilities and premises;
- censusing of pets (dogs and cats) with annual data updating;
- oversight of adherence to pet and livestock keeping regulations by private owners and agricultural organizations;
- procurement of anti-rabies parenteral vaccine for immunization of pets and farmed animals;
- vaccination of pets (dogs and cats) against rabies;
- establishing and maintaining continuously renewed stock of anti-rabies vaccine and immunoglobulins in the regions and in city of Minsk sufficient to meet simultaneous demand for at least 20 persons;
- provision of post-exposure treatment to the exposed persons following the contact with animals;
- compiling the lists of persons at high risk of rabies virus infection (veterinarians, hunters, foresters, persons engaged in trapping and keeping stray animals, and others) and submission of these lists to regional public health authorities, as well as authorities responsible for official sanitary surveillance;

- preventive vaccination of persons at high risk of rabies virus infection;

- public awareness campaign across all media (including Internet resources) to raise awareness of rabies prevention measures among the persons of various age and professional groups, including: manifestations of rabies virus infection, actions to be taken in case of contact with animals, including rabid and rabies suspected animals, the consequences of refusing or interrupting rabies post-exposure treatment, as well as the rules for pet and livestock keeping, such as timely registration of animals and timely vaccination of animals against rabies.

Another area of the State Veterinary Service activities is the continuous monitoring and specific rabies prophylaxis improvement, when necessary, among wild carnivores kept in zoos, stray animals and animals kept in shelters. These animals pose a substantial risk to staff, and their rabies vaccination history is often uncertain. In such situations, parenteral rabies prophylaxis is highly risky and difficult. Consequently, current efforts include analysing and evaluating existing rabies vaccination methods for carnivores in shelters and zoos.



Fig. 2. Feeding oral immunization baits to foxes

This work is coupled with the development of improved anti-rabies vaccine baits and an assessment of their efficacy in these controlled environments (Figs. 1 and 2).

To enhance disease control and cost-effectiveness, the efforts are focused on development of improved designs of the baits for captive and stray carnivores and wildlife. Experimental bait models are being developed by the OJSC “BelVitinopharm” specialists. “Rabivit-VBF”, rabies vaccine-containing bait, series No. 19 (22 g), was taken as a basis (prototype) and improved: its shape, size and composition were changed. New types of baits were experimentally tested in various groups of animals in order to identify the most effective form for the bait uptake. The tests were carried out in the Vitebsk Zoo and “Dobrik”, Vitebsk shelter for stray animals, where oral baits were fed to wolves, foxes, raccoon dogs, domestic dogs and cats.

Our own tests performed for evaluation of oral rabies vaccination for its effectiveness yielded the following results.

1. According to video surveillance, animals actively consumed improved baits of all types (both old and new) within the first two days, but showed a distinct preference for the new ones.

2. It was observed that wild animals, particularly foxes, often do not consume baits at the drop point but instead relocate them for later consumption. This behaviour is a critical factor to consider during the visual assessment of bait uptake.

3. In the experiment conducted under near-natural conditions in the Vitebsk Zoo, the average uptake of all new-formulation baits was high, reaching 82%.

4. It was found that under adverse weather conditions, including heavy rain, the tested baits retained their original shape and form. Bait uptake was the highest in the evening and at night.

Thus, the experiment results indicate that the most modified baits tested meet the specified parameters and are suitable for the oral rabies vaccination of carnivores and wild animals in the Republic of Belarus. The new-formulation baits are cost-effective and will increase the effectiveness of oral rabies vaccination for wild carnivores across the country.

According to the Ministry of Health of the Republic of Belarus, in recent years, mass exposures of humans to rabid animals have become an alarming trend. While most incidents involve pets (dogs and cats) and livestock (sheep, goats and cattle), exposures to wild animals (foxes, raccoon dogs, hedgehogs), though less frequent, are also a significant concern. In agriculture, mass exposures are often occupational, whereas those with pets and wild animals typically result from human negligence, a lack of understanding about the severity of the risk, and the potential threat of rabies. Particularly noteworthy is the contemporary “selfie epidemic” spreading among the public. In several cases, it was the reckless pursuit of a photo with a wild animal – not a lack of knowledge about the disease – that led to mass exposures to a rabid animal. The public’s frequent refusal to vaccinate pets was the second major factor contributing to their infection and the most common cause of mass exposures to rabid domestic animals. The reason for this is the pet’s so-called “indoor lifestyle” and the pet owner’s belief that it has little to no contact with the outside environment or other animals. Ignoring the potential risks of infection, despite possible or actual contact with wild or stray animals, leads to pet infections and, subsequently, to mass human exposures.

The growing populations of wild animals including ungulates (e.g., deer, roe deer), carnivores, and omnivores (e.g., foxes, raccoon dogs, wolves, lynx, bears) in several regions of the Republic of Belarus is a significant

contributing factor. This increase elevates the risk of rabies spread among animal populations, thereby amplifying the biological threat to humans. This is particularly true for high-risk groups such as hunters, gamekeepers, foresters, staff of nature reserves and national parks, zoologists, and others whose professional or scientific activities involve contact with wildlife.

It is also crucial to intensify public awareness campaigns on rabies prevention, targeting various demographic and professional groups, with a primary focus on children. The most vulnerable group – elementary school students – is of particular concern. This includes personal meetings between humane medicine practitioner, veterinarians and parents as well as dissemination of information through mass media platforms.

To facilitate easy and accessible understanding of the importance and danger of rabies for various demographic and professional groups, informational materials (posters, presentations, educational films) are being developed. Furthermore, different speakers are selected to best engage each target audience: educational sessions for children are conducted by students, Master's Degree candidates, or postgraduates from the Vitebsk State Academy of Veterinary Medicine, educational sessions for adults are conducted by the State Veterinary Service staff-members and officers of the Epidemiological Service of the Ministry of Health of the Republic of Belarus. This tailored approach ensures the message is delivered in the most relatable and effective way for each audience, maximizing both comprehension and retention of critical information about rabies [10].

Special attention is also given to public awareness campaign targeting pet owners and to control of pet registration and vaccination by municipal services and the State Veterinary Service. These activities aim to clarify pet keeping regulations for the public, emphasizing the critical importance of timely animal registration and anti-rabies vaccination.

CONCLUSION

Thus, rabies remains a significant concern in the Republic of Belarus, particularly in wildlife. Given the increasing density of wild ungulate, carnivore, and omnivore populations, the risk of rabies infection is rising among both livestock animals and pets as well as humans. Intensive ongoing efforts for rabies prevention are taken. Key rabies control measures primarily involve the oral vaccination of wild animals and public awareness campaigns. To achieve a sustained reduction in rabies cases in both wild and domestic animals, and to lower the disease risk to humans, we consider it essential to further expand the geographic coverage of oral rabies vaccination campaigns, ultimately encompassing the entire territory of the Republic of Belarus. Concurrently with the expansion of the oral rabies vaccination program for wild carnivores, it is necessary to enhance the control and intensity of the anti-rabies vaccination program for dogs and cats.

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