

Monitoring of Infectious Cattle Diseases in Tyumen Region

Zverev R. N^{*1}, Kurtekov V. A² and Stolbova O. A^{2,3}

¹*Institutskaya Street 2 Building Tyumen 625041 Russia*

²*Institute of Biotechnology and Veterinary Medicine, Federal State Budgetary Educational Institution of Higher Education State Agrarian University of the Northern Trans-Urals” Respubliki Street Tyumen Russia. 625003*

³*All-Russian Research Institute of Veterinary Entomology and Arachnology – the branch of the Federal State Budgetary Institution of Science, the Federal Research Center of the Tyumen Scientific Center, the Siberian Branch of the Russian Academy of Sciences, Institutskaya str. Tyumen, Russia. 625041*

ABSTRACT

The epizootic situation remains unfavorable for many animal diseases in the Russian Federation. The diseases of infectious etiology are regularly recorded among cattle, causing enormous economic damage to beef and dairy cattle breeding. Hence, this article makes an attempt to present an analysis of the epizootic situation concerning the infectious ethologydiseases in the Tyumen region. To meet the aim of the article, research within the framework of scientific work was carried out on the basis of the Veterinary Directorate of the Tyumen Region, at the Department of Non-communicable Diseases of Farm Animals, the Federal State Budgetary Educational Institution of Higher Education SAU of Northern Trans-Urals, the acarology laboratory of the All-Russian Research Institute of Veterinary Entomology and Arachnology - the branch of the Tyumen Scientific Center of the SB RAS and subordinate state veterinary institutions during the period from 2017 to 2019. Among the infectious diseases of cattle, they record anthrax, epizootic apthae, infectious nodular dermatitis, tuberculosis, brucellosis, and leukemia. The monitoring of diseases of infectious etiology in the Tyumen region enables us to state only isolated cases of infectious nodular dermatitis - 11 cases in 2019. Based on the results obtained from the experiment, it can be concluded that only isolated cases of infectious nodular dermatitis were recorded - 11 cases, and bovine leukemia - 620 cases in the Tyumen region (2019). Based on the results of the data obtained and a more detailed analysis of measures to treat and prevent infectious diseases, it is advisable to introduce additional and systemic preventive measures.

KEY WORDS: CATTLE, EPIZOOTIC APHTHAE, INFECTION, INFECTIOUS NODULAR DERMATITIS, THE DISEASES OF INFECTIOUS ETIOLOGY.

INTRODUCTION

These are sporadic outbreaks of anthrax, which were registered in the Republic of Altai, Dagestan (2017), the outbreaks of epizootic apthae recorded in the Republic of Bashkortostan (2017), and in the Trans-Baikal Territory (2018) (Glazunov and Glazunova, 2015). This is the disease of large cattle with contagious nodular dermatitis, which has spread from the southern borders of the country to more than 30 constituent entities of the Russian Federation since 2015 (Kononov et al., 2017). Over the past 3 years, 27 outbreaks of cattle tuberculosis

have been recorded in various regions of the country (Stolbova et al., 2014; Stolbova et al., 2016; Stolbova, 2019; Stolbova & Skosyrskikh, 2020).

Bovine leukemia virus breaks out to dominant positions and occupies one of the first places in the structure of infectious pathology among cattle (Sheikhshoae et al, 2018; Sajjadi and Moosavi, 2019) Leukemia is widespread throughout the Russian Federation. The economic damage from infectious diseases of cattle consists primarily of disease elimination costs, carrying out restrictive measures, in some cases of compensation to animal owners for the removal of animals when especially dangerous diseases are detected, deaths, forced slaughter and culling of sick animals, reduced productivity, economic activity

Article Information:*Corresponding Author: ZverevRN@72to.ru.

Received: 19/04/2021 Accepted after revision: 27/06/2021

Published: 30th June 2021 Pp- 740-746

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Article DOI: <http://dx.doi.org/10.21786/bbrc/14.2.46>

restriction, the cost of health-improving activities (Pavlik et al., 2020; Dittrich et al., 2021).

Russia in general and the Tyumen region in particular are aimed at domestic beef production increase in the long term and meat self-sufficiency reaching declared in the Doctrine of Food Security of the Russian Federation, the level of which must be 85% at least (Stolbova et al., 2014; Glazunov & Glazunova, 2015; Stolbova et al., 2016; Stolbova, 2019; Stolbova, 2020; Stolbova & Skosyrskikh, 2020). As the part of the Tyumen region strategy for the development of export potential, the task was set to increase the number of cattle, as well as to increase the production of livestock products - milk, meat, to obtain veterinary safe livestock products, and in some cases the products that meet the more stringent requirements of those countries where export of these products is planned (Stolbova, 2020).

All this is impossible without analyzing the incidence of various diseases among animals, primarily infectious, including especially dangerous ones, causing much more significant economic damage, studying the measures to combat and prevent these diseases, as well as identifying new, previously unexplored, factors in the spread of infectious diseases (Huffaker and Hartmann, 2021). As mentioned earlier, the main objective of the study is to monitor and assess the impact of factors stipulating the spread of infectious diseases among cattle in the Tyumen region. Due to an increase in the outbreak of these kind of diseases among castles in Russia, over the past years, it seems vital to investigate these infectious diseases closely and figure a way to tackle them properly.

MATERIAL AND METHODS

To monitor infectious diseases, the transmission of which is possible through sexual contact, we used the data of

veterinary reporting in the context of municipalities and the Tyumen region on the registration of facts and ongoing anti-epizootic measures of animal diseases according to the form No. 1-BET. In the course of the study, they analyzed the data of veterinary reporting generated by the State Autonomous Institutions of the Tyumen Region, by inter-district veterinary centers, the city station for animal disease prevention, the regional veterinary laboratory and the regional anti-epizootic detachment, including the data on the number of animals in the context of animal species, sex and age groups, the data on artificial insemination of cattle, the laboratory data, the data accompanying the collection of blood samples and pathological material, the acts of epizootic examination of disease foci when they are detected, etc. (Kononov et al., 2017; Shevchenko et al., 2019; Dittrich et al., 2021).

RESULTS AND DISCUSSION

The epizootic situation on the territory of any subject largely depends on the organization quality of veterinary preventive measures. In accordance with the Order of the Ministry of Agriculture of the Russian Federation No. 189 "On the Regulations for Submitting Information to the System of State Information Support in the Sphere of Agriculture" (02.04.2008), the state bodies of the constituent entities of the Russian Federation draw up and send information on infectious animal diseases to the Ministry of Agriculture of Russia quarterly. According to the results of the veterinary reporting analysis formed and directed by the Veterinary Directorate of the Tyumen Region to the Ministry of Agriculture of Russia, leukemia and infectious nodular dermatitis were recorded in the region from infectious diseases of cattle during the period from 2017 to 2019, the transmission of which is possible through sexual contact (Table 1).

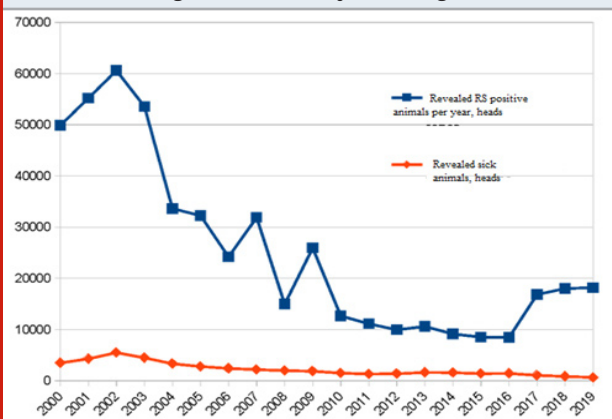
Table 1. The number of cases of cattle with infectious diseases, the transmission of which is possible sexually

Item No	Disease name	2017	2018	2019
1	Infectious Dermatitis Nodosa (cattle)	0	0	11
2	Leukemia (cattle)	1031	827	620
3	Anthrax	Not recorded		
4	Epizootic aphthae			
5	Tuberculosis			
6	Brucellosis			

Taking into account the actually recorded cases of disease among cattle, a more detailed analysis of leukemia and infectious nodular dermatitis incidence was carried out among cattle within the framework of this study in order to study in detail the causes and spread of these diseases, as well as to assess the influence of their sexual transmission factor in the epizootic chain (Huffaker and Hartmann, 2021; Dittrich et al., 2021). The

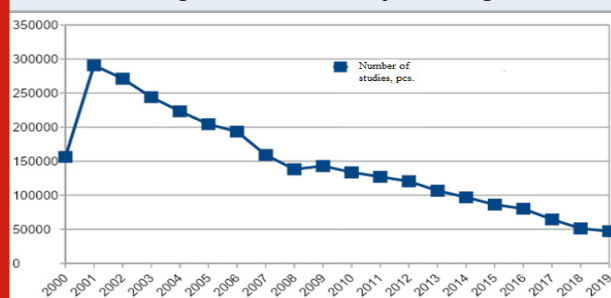
disease of leukemia among cattle is regularly recorded in almost all areas of the Tyumen region. For more detailed monitoring, the analysis of the incidence has been carried out since 2000, when the veterinary service of the Tyumen region began to apply the current Rules for the prevention and control of leukemia among cattle, approved by the order of the Ministry of Agriculture of the Russian Federation No. 359 (05/11/1999).

Figure 1: Dynamics of incidence and infection with leukemia among cattle in the Tyumen region



The dynamics of leukemia disease among cattle, as well as the data on the identified virus carriers. Information on the number of studies carried out by the hematological method, as indicated above, the animals previously studied by the serological method and recognized as virus carriers are subsequently examined only by the

Figure 2: Dynamics of conducted hematological studies for leukemia among the cattle in the Tyumen region



hematological method (Pavlik et al., 2020) (Figure 1). It should be borne in mind that, depending on the infection of the farms, animals that are not infected with the bovine leukemia virus may also enter the statistics of hematological studies. If more than 30% of cows and heifers are found infected with the bovine leukemia virus on some farm, and it is not possible to carry out health-improving measures by separating healthy and infected animals, all adult animals, including healthy ones, are examined only by the hematological method every 6 months (Stolbova, 2020; Dittrich et al., 2021).

Table 2. Dynamics of conditional cattle leukemia infection in the context of municipal districts (group No. 1 with the highest infection rate)

District	Coverage by hematological examinations, % (conditional infection) of cattle for leukemia by years		
	2017	2018	2019
	Aromashevsky	43,0	18,5
Vikulovsky	35,9	33,0	18,0
Zavodoukovsky	28,9	19,1	11,2
Isetsky	29,2	24,6	29,2
Sladkovsky	25,5	26,0	25,0
Uporovsky	54,8	28,5	22,6
Yurginsky	25,9	23,1	23,3
Average for group No. 1	34,4	25,7	21,6
Regional average	19,9	14,9	14,9

The largest number of cattle with leukemia was identified in 2002 - 5 434 heads. The smallest number was recorded in 2019 - 620 heads, which is 8.8 times less. The overall dynamics of leukemia decrease over the indicated period made 4.9% per year on the average. Most of the animal virus carriers were also detected in 2002 - 60,602 heads. By 2019, the number of animal virus carriers detected annually decreased to 18,166 heads, which is 3.3 times less. At the same time, the number of hematological examinations conducted over the specified period decreased by more than 5.7 times (271,241 examinations in 2002, 47,135 examinations in 2019) (Figure 2). The increase of detected infected animals during the period from 2017 to the present, as compared with lower rates in 2010-2016, is explained by the fact that the serological method was also used to study farm

animals, the infectivity of which is more than 30%, and which were previously studied only by the hematological method and accordingly, they were not included in the statistics of virus carriers detected during the reporting year (Stolbova, 2020; Pavlik et al., 2020).

In order to analyze the causes of leukemia incidence among cattle, they studied the acts of the epizootic survey of farms. Given the long incubation period, the etiology of the disease does not contain the data indicating a possible sexual route of leukemia infection in the veterinary documents. To identify the influence of leukemia sexual transmission, an additional comparative analysis of cattle infection dynamics with leukemia in personal subsidiary plots was carried out in conjunction with the cattle population coverage by artificial

insemination in the context of the municipal districts of the Tyumen region. Studies have established that in case of free mating, there may be violations of the mucous membrane of the cervix, which contributes to

the penetration of leukocytes affected by the virus into the animal's body and, accordingly, the infection of the animal with the bovine leukemia virus occurs.

Table 3. The dynamics of conditional cattle leukemia infection in the context of municipal districts (group No. 2 with the lowest infection rate)

Region	Coverage by hematological examinations, % (conditional infection) of cattle for leukemia by years		
	2017	2018	2019
Vagaysky	0,4	0	0,3
Kazansky	6,8	4,4	3,8
Nizhnetavdinsky	6,1	5,9	7,7
Tobolsky	0	0	0,7
Uvatsky	0,3	0,3	3,7
Yalutorovsky	9,8	5,6	18,6
Average for group No. 2	5,5	3,7	7,5
Regional average	19,9	14,9	14,9

Table 4. Dynamics of newly detected cattle leukemia virus carriers in the context of municipal districts (group No. 1)

District	The share of newly positive detected RID animals, %		
	2017	2018	2019
Aromashevsky	16,0	13,6	9,7
Vikulovsky	12,3	11,7	13,0
Zavodoukovsky	15,0	13,8	7,0
Isetsy	10,6	12,1	12,3
Sladkovsky	22,0	20,5	16,2
Uporovsky	14,0	13,4	11,3
Yurginsky	22,9	30,6	30,9
Average for group No. 1	15,7	15,5	12,9
Regional average	13,2	12,8	11,6

This is almost impossible during artificial insemination (Huffaker and Hartmann, 2021). Considering that different degrees of animal infection directly affect the degree of re-infection of animals with leukemia, the analysis was carried out taking into account this circumstance. The municipal districts in which the conditional infection rate (the coverage by hematological studies) was more than 20% (above the regional average according to the data of 2017) were grouped into one group - these are Aromashevsky, Vikulovsky, Zavodoukovsky, Isetsy, Sladkovsky, Uporovsky and Yurginsky districts (Table 2). During the study, a significant and stable decrease in conditional infection was noted in Aromashevsky, Vikulovsky, Zavodoukovsky and Uporovsky districts. The conditional infection rate in the Isetsy, Sladkovsky and Yurginsky districts has not changed almost.

At the same time, the municipal districts, in which the conditional infection rate (the coverage by hematological examinations) was the lowest and amounted to less than 10%, were grouped into the second group. This group includes Vagaysky, Kazansky, Nizhnetavdinsky, Tobolsky, Uvatsky and Yalutorovsky districts (Table 3). A stable decrease in conditional infection was noted only in the Kazan district within the second group of the analyzed districts over three years. In other regions, the infection rate remained unchanged or, on the contrary, increased. In addition, they performed the analysis of newly detected animal virus carrier dynamics according to the results of serological studies in these two groups (Table 4, 5). This information reflects the proportion of newly detected virus carriers among previously healthy or RID negative animals, that is, it shows the direct infectivity of animals with leukemia.

Table 5. Dynamics of the newly detected animal carriers of cattle leukemia in the context of municipal districts (group No. 2)

District	The share of newly detected RID positive animals, %		
	2017	2018	2019
Vagaysky	1,7	0,7	1,3
Kazansky	8,8	6,8	4,6
Nizhnetavdinsky	6,6	7,0	6,9
Tobolsky	3,4	2,2	3,6
Uvatsky	1,8	6,3	8,2
Yalutorovsky	9,1	10,0	9,8
Average for group No. 2	6,7	6,2	5,9
Regional average	13,2	13,1	11,6

Figure 3: Dependence of newly detected animal virus carriers on artificial insemination coverage

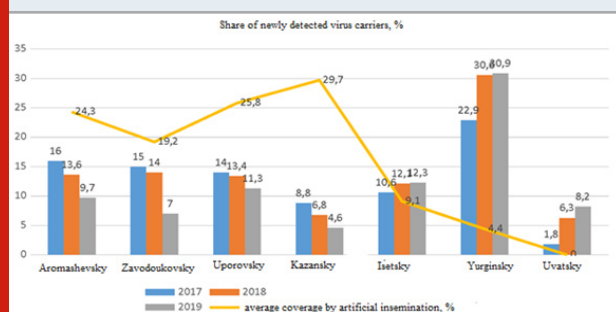
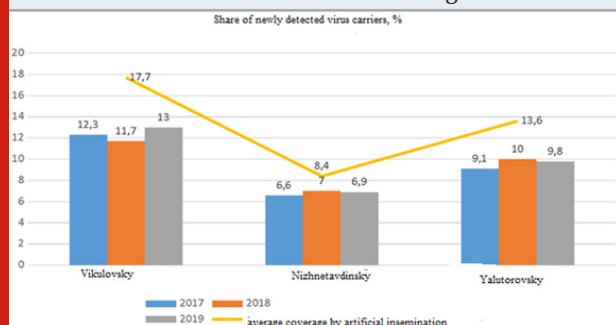


Figure 4: Dependence of newly detected animal virus carriers on artificial insemination coverage



The analysis of newly detected virus carrier share is very important, since it directly reflects the result and effectiveness of the measures taken to prevent and eliminate leukemia among cattle. The increase in re-infectivity clearly shows an unsatisfactory and insufficient complex of veterinary-prophylactic and organizational measures. A steady decline of newly detected animal virus carriers was noted for the period from 2017 to 2019 in Aromashevsky, Zavodoukovsky, Sladkovsky and Uporovsky districts. On the contrary, Vikulovsky, Isetsky and Yurginsky districts demonstrated increase of RID positive animals detected during serological studies (Pavlik et al., 2020).

In general, taking into account the analysis of data on the conditional infection of animals and the proportion of newly detected virus carriers, a positive result of infected animals stable decrease was noted in Aromashevsky, Zavodoukovsky and Uporovsky districts. An increase in the number of newly detected RID positive animals is observed in the Isetsky and Yurginsky districts, with almost unchanged level of conditional infection. There is no system dynamics in Vikulovsky and Sladkovsky districts. In some cases, there is an increase, in some cases, on the contrary, a decrease in either conditional infection or the proportion of newly detected virus carriers (Dittrich et al., 2021).

A stable decrease of newly detected animal virus carriers was noted only in the Kazan region during the period from 2017 to 2019. On the contrary, there is an annual increase of RID positive animals in the Uvatsky region, detected during serological studies. The changes are insignificant in Vagaysky, Nizhnetavdinsky, Tobolsky and Yalutorovsky districts. No systemic dynamics is observed for the rest of the regions of the 2nd group. In some cases, there is an increase, or some decrease in either conditional infection or in the proportion of newly detected virus carriers. Taking into account the analysis of the data based on the results of the study, an inversely proportional relationship is observed between the dynamics of leukemia infection among animals and the number of animals that are artificially inseminated. Some increase in the coverage of the cattle population with artificial insemination in dynamics leads to the decrease of both newly detected virus carriers and the conditional infection of animals, determined on the coverage of the cattle population by hematological studies.

This tendency was revealed both in group No. 1 with a high degree of livestock infection - in Aromashevsky, Zavodoukovsky and Uporovsky districts, and in group No. 2 with a low degree of infection - in Kazan district. Accordingly, a lower coverage of the livestock of animals by artificial insemination leads to newly detected virus carrier increase and to the conditional infection increase

among animals. This trend was also found in both groups. Group No. 1 - in the Isetsky and Yurginsky districts, group No. 2 - in the Uvatsky district, where, despite the very low infection of animals with leukemia in the absence of artificial insemination, the share of newly detected animal virus carriers increased to 8.2% per year or in 4.5 times over three years (Figure 3).

In group No. 1 with a high degree of infection of the livestock, and in group No. 2 with a low degree of infection, the areas were identified where the coverage by artificial insemination averages from 8.4% to 17.7% (Vikulovsky, Nizhnetavdinsky and Yalutorovsky districts). The dynamics of the conditional infection of animals and the proportion of newly detected animal virus carriers in these areas fluctuates either upward or downward (Figure 4). There is no systemic dynamics.

Thus, it can be concluded that the factor of sexual transmission in case of bovine leukemia is present, and in order to obtain a positive result from artificial insemination for the prevention of bovine leukemia and to minimize the factor of the disease transmission during free mating, the coverage of artificial insemination should be at least among 18% of the available livestock. During the analysis, infectious nodular dermatitis was first registered in the Tyumen region in 2019. In total, 11 cases of the disease were recorded, including the Kazansky district - 6 cases; Abatsky district - 1 case; Sladkovsky district - 4 cases. By the decisions of the Veterinary Directorate of the Tyumen Region, restrictive measures were established in all cases, a complex of veterinary preventive measures was taken to eliminate and prevent the disease spread.

To find out the causes of the disease onset, they analyzed the documents on the establishment of restrictive measures, the acts of epizootic examination, expert evaluations, accompanying documents to the selected samples, the submissions from state veterinary inspectors, and veterinary reporting data (Sajjadi and Moosavi, 2019). The facts that give reason to assume that the infection of animals occurred sexually, are not confirmed in any of the recorded cases. There were no facts of artificial insemination and sexual intercourse during the period of 30 days before the detection of diseases. The absence of disease sexual transmission factor is also confirmed by the absence of contagious nodular dermatitis infection cases among other susceptible animals during the outbreak (Dittrich et al., 2021).

The most likely route of infection is transmissible, i.e., mechanical transfer of various species by arthropods. All cases of the disease were detected during the period from 05/23/2019 (1 case) to 10/04/2019 (the last case), when an active flight of blood-sucking insects was observed. With the cessation of flight of insects, the cases of infectious nodular dermatitis were no longer recorded among cattle (Pavlik et al., 2020). Thus, we can conclude that in cases of cattle infection with nodular dermatitis in the Tyumen region, the factor of the disease sexual transmission has not been established.

CONCLUSION

Based on the study results, they studied the features of infectious diseases among cattle, the transmission of which are possible sexually. These are infectious, including especially dangerous diseases such as anthrax, epizootic apthae, infectious nodular dermatitis, tuberculosis, brucellosis and leukemia. The monitoring of diseases of infectious etiology in the Tyumen region allows us to state only isolated cases of infectious nodular dermatitis - 11 cases in 2019. At the same time, the cases of bovine leukemia are detected regularly and everywhere throughout the region - from more than 5 thousand cases annually at the beginning of 2000 and up to 620 cases by the end of 2019. When analyzing control and prevention measures, taking into account the constantly changing epizootic situation, constant monitoring of these diseases is necessary, and it is advisable to introduce additional and systemic preventive measures to prevent cattle leukemia.

ACKNOWLEDGEMENTS

The authors received no direct funding for this research.

Conflict of Interests: the authors declare that there is no conflict of interest in this study.

Ethical Clearance Statement: The Current Research Work Was Ethically Approved by the Institutional Review Board (IRB) of Institution of Higher Education State Agrarian University of the Northern Trans-Urals" Respubliky Street Tyumen Russia.

REFERENCES

- Dittrich I, Gertz M, Maassen-Francke B, Krudewig KH, Junge W and Krieter J (2021). Variable selection for monitoring sickness behavior in lactating dairy cattle with the application of control charts. *Journal of Dairy Science*. Doi.org/10.3168/jds.2020-19680.
- Glazunov YuV, Glazunova LA (2015). Cattle leukemia in the Tyumen region. *Modern Problems of Science and Education*. Vol No 3, pp 600-611.
- Huffaker R and Hartmann M (2021). Reconstructing dynamics of foodborne disease outbreaks in the US cattle market from monitoring data. *Plos One*, Vol 16 No1, e0245867.
- Kononov AV, Rakhmanov AM and Shumilova IN (2017). The features of the clinical and anatomical manifestation of infectious nodular dermatitis among cattle (lumpy dermatitis) and its diagnosis. *Bulletin of AIC Stavropol*. Vol 28 No 4 pp 30-32.
- Pavlik KS, Yakushkin IV and Stolbova OA (2020). The features of veterinary and sanitary measure organization and conduct to prevent lumpy dermatitis among cattle. *AIC: Innovative Technologies*. No 3 pp 21-28.
- Stolbova OA, Glazunov YuV and Nikonov AA (2016).

Skin pathologies among cattle in the Northern Trans-Ural region. International Research Journal. Vol 50, No 8 pp 28-30.

Sajjadi A and Moosavi SM (2019). Synthesis of polymer-coated RDX/AP nano-composites using supercritical CO₂. Journal of Medicinal and Chemical Sciences. Vol 1 No 1 pp 9-10.

Stolbova OA, Glazunova LA, Nikonov AA, Glazunov YuV and Skosyrskikh LN (2014). Insects and ticks cattle parasites in the Northern Trans-Ural region. Fundamental Research. No. 11-12 pp 2650-2655.

Sheikhshoae I, Sheikhshoaei M and Ramezanzpour S (2018). Synthesis and Characterization of Nano Sized ZnO and CdO by Direct Thermal Decomposition of Their Nano Sized Metal Schiff base Complexes. Chemical Methodologies, Vol 2 No2 pp 103-113.

Shevchenko AA, Chernykh OYu, Konovalov MG and Erdniev BS (2019). Epizootic situation, symptoms and prevention of nodular dermatitis in the Krasnodar Territory. Proceedings of the Kuban State Agrarian University. No 7. pp 194-198.

Stolbova OA (2020). Distribution of Bovine Demodicosis in the Forest-Steppe Zone of the Northern Trans-Urals. HELIX. 2020. Vol 10 No 5 pp44-47.

Stolbova OA and Skosyrskikh LN (2020). change of immunological blood indicators during follicular cattle mange. Eurasian Journal of Biosciences. Vol 14 No 1 pp1055-1058.

Stolbova OA (2019). Parasitic activity of demodex ticks among cattle. Indo American Journal of Pharmaceutical Sciences. Vol 6 pp 13337-13341.