ECOLOGICAL AND SPATIOTEMPORAL DRIVERS OF RABIES PERSISTENCE IN REPUBLIC OF MOLDOVA (2022–2024)

BALACCI Sergiu, BĂLAN Ion, ROȘCA Nicolae, BUZAN Vladimir

Abstract. The study analyzes the evolution of rabies in the Republic of Moldova in the period 2022-2024, focusing on geographical distribution, spread trends and factors influencing disease incidence. In 2022, 13 cases of rabies were reported, mainly located in the central and north-western regions of the country. In 2023, the number of cases increased to 24 (+84.62%), which led to an expansion of the rabies virus area to the northeast, covering the entire territory of the left bank of the Dniester River. In 2024, there was a decrease in the number of cases to 18 (-25% compared to 2023), along with a reduction in the affected territorial area, However, compared to 2022, the incidence of rabies remained higher (+38.5%), which indicates the persistence of the virus in certain areas. The localities with high incidence are Rezina, Briceni, Edinet and Slobozia, where rabies affected both domestic animals (cattle, dogs, cats) and wild animals (foxes, jackals, martens). In these areas, the sustained circulation of the virus is favored by the high density of animals, the proximity of their habitats and insufficient prevention measures. In terms of time, rabies cases were more frequent in August-December, which can be correlated with the intensification of interactions between domestic and wild animals. The persistence of outbreaks in the same localities suggests the existence of active reserves of the virus in the local fauna and the need for more rigorous control measures. In conclusion, the results indicate a complex rabies dynamics in the Republic of Moldova, influenced by ecological and anthropogenic factors. To reduce the incidence of the disease, it is recommended to intensify vaccination campaigns, increased epidemiological surveillance, apply effective measures to control the wild animal population, as well as promote a stricter legislative framework on the management of wild and domestic animals in high-risk areas.

Keywords: rabies, geographic distribution, spread trends.

Rezumat. Factori ecologici și spațio-temporali ai persistenței rabiei în Republica Moldova (2022–2024). Studiul analizează evoluția rabiei în Republica Moldova în perioada 2022-2024, concentrându-se pe distribuția geografică, tendințele de răspândire și factorii care influențează incidența bolii. În 2022, au fost raportate 13 cazuri de rabie, localizate preponderent în regiunile centrale și nord-vest ale țării. În 2023, numărul cazurilor a crescut la 24 (+84,62%), ceea ce a condus la o extindere a arealului virusului rabic către nord-est, acoperind întreg teritoriul malului stâng al râului Nistru. În 2024, s-a înregistrat o scădere a numărului de cazuri la 18 (-25% față de 2023), alături de o reducere a suprafeței teritoriale afectate. Comparativ cu 2022, incidența rabiei a rămas mai ridicată (+38,5%), ceea ce indică persistența virusului în anumite zone. Localitățile cu incidență ridicată sunt Rezina, Briceni, Edineț și Slobozia, unde rabia a afectat atât animale domestice (bovine, câini, pisici), cât și sălbatice (vulpi, șacali, jderi). În aceste zone, circulația susținută a virusului este favorizată de densitatea ridicată a animalelor, proximitatea habitatelor acestora și măsuri de prevenție insuficiente. Pe plan temporal, cazurile de rabie au fost mai frecvente în lunile august-decembrie, ceea ce poate fi corelat cu intensificarea interacțiunilor dintre animalele domestice și cele sălbatice. Persistența focarelor în aceleași localități sugerează existența unor rezerve active de virus în fauna locală și necesitatea unor măsuri de control mai riguroase. În concluzie, rezultatele indică o dinamică complexă a rabiei în Republica Moldova, influențată de factori ecologici și antropici. Pentru reducerea incidenței bolii, se recomandă intensificarea campaniilor de vaccinare, supravegherea epidemiologică sporită, aplicarea unor măsuri eficiente de control al populației de animale sălbatice, precum și promovarea unui cadru legislativ mai strict privind gestionarea animalelor sălbatice și a celor domestice în zonele cu risc înalt.

Cuvinte cheie: rabie, distribuție geografică, tendințe de răspândire.

INTRODUCTION

Rabies is a viral disease usually transmitted by bites or scratches from infected animals, and its distribution varies significantly depending on the species affected and the ecological context in which it manifests itself. The studies carried out by ELLISON et al., (2013) and SMITH et al., (2002), have highlighted that, in particular, carnivores, such as foxes, dogs, but also bats, are species frequently affected by rabies. Within wildlife, some species are more vulnerable in certain ecological regions, such as temperate forests or areas with open habitats, due to high population density and interactions between animals (WUNNER & BRIGGS, 2010; MA et al., 2018; YANG et al., 2018; CAMPOS et al., 2020;).

Geographically, rabies has an irregular distribution depending on the affected species, but also on the locality where the cases are reported. For example, in certain areas of Africa or Asia, rabies is more commonly reported in dogs and other domestic animals, while in temperate or mountainous regions of Europe and North America, bats play the leading role in the spread of the virus, acting as natural reservoirs (GONGAL & WRIGHT, 2011; MA et al., 2018). GEORGE et al., (2011) emphasize that the geographical area influences the typology of species involved in rabies transmission, and this distribution is particularly important in the formulation of prevention strategies based on the specificity of the region.

The temporal distribution of rabies is also a crucial factor. In temperate regions, rabies cases may be more common at certain times of the year, related to animal migration or seasonal changes in behavior. For example, in North American regions, during bat migration, the number of cases may increase, as infected animals move long distances, contaminating new territories. This aspect was also underlined by the studies carried out by HIKUFE et al., (2019), which linked the migration behaviors of wild species with the occurrence of rabies outbreaks at different times of the year.

Rabies ecology, i.e. the study of the interactions between viruses, species and the environment, is a particularly important field to understand how and why the disease spreads. An important aspect that influences the spread of rabies is the density of wild animal populations. For example, in regions where fox populations are very large, the risk of transmission of the disease increases significantly. These animals are often more exposed to infection due to their social behavior and interactions with other carnivores, including stray dogs or other wildlife (MÜLLER et al., 2015; SMITH & WILKINSON, 2023).

Another particularly important ecological factor is the migration of wild animals. As GEORGE et al., (2011) point out, the seasonal migration of animals, especially bats or some carnivores, can amplify the spread of rabies over a wider area, especially in regions where there are no effective control measures. Migration favours the transfer of the virus between ecologically isolated areas, where there could be vulnerable populations of domestic or wild animals, thus contributing to the global spread of rabies. This is a complex dynamic that requires longitudinal studies to understand how species migration behaviors influence rabies epidemiology.

Similarly, climate change can affect how certain species migrate and how they are distributed in different ecosystems. For example, changes in temperature can influence the length of the activity season of bats or other wildlife, which in turn can alter the temporal distribution of rabies cases. HIKUFE et al., (2019) emphasized this point, arguing that climate change will have a direct impact on rabies dynamics in wild and domestic fauna, by altering natural habitats and animal migrations.

Socio-economic factors are essential for understanding the distribution of rabies and for implementing effective prevention strategies (SUBEDI et al., 2022). The WORLD HEALTH ORGANIZATION (2013) highlighted that regions with poor health infrastructure and limited access to rabies vaccines have higher rates of human mortality from rabies. In many developing countries, public health systems are not sufficiently prepared to respond quickly and effectively to rabies outbreaks, and limited access to rabies vaccines and post-exposure treatments is a major barrier to disease control.

Also, studies conducted by BRIGGS (2012) in rural areas have highlighted that the lack of an effective vaccination system for domestic animals can maintain a high risk of rabies transmission. In areas where contact between domestic and wild animals is common, especially during migration or in regions with high animal density, vaccination measures are essential to prevent rabies outbreaks (BANYARD et al., 2018; LOJKIĆ et al., 2021). Some rural communities in developing countries, due to limited resources, do not have the capacity to implement large-scale vaccination campaigns, which makes the rabies problem persist at the local and regional levels.

In these regions, education and public awareness play a crucial role. Increasing the level of information about the risks of rabies and the importance of vaccinating animals can significantly reduce the risks of infection and help reduce the number of human and animal cases. CLEAVELAND et al., (2014) argue that an integrated approach is needed, combining rabies prevention measures in domestic and wild animals with educational campaigns and community mobilization strategies.

For effective rabies control, research shows that a multidisciplinary approach that integrates ecological, epidemiological, social and economic aspects is essential. Geospatial and temporal modelling studies, such as those conducted by SHUAICHENG (2022), suggest that the incidence of rabies should be assessed within a geographical and temporal framework that takes into account the distribution of animals, their density, and local environmental factors. This data is essential for the development of localized control strategies, adapted to each region and each species involved.

At the same time, wildlife population management measures and vaccination are essential to prevent the spread of rabies. VITASEK (2004) and WANDELER (1988) pointed out that, in certain areas with high wildlife density, animal capture and vaccination interventions are the most effective prevention strategies. Recent studies also show that the success of these measures depends to a large extent on coordination between public health authorities, environmental protection and local communities, in order to implement appropriate solutions at the local level.

Therefore, the distribution and spread of rabies are influenced by a wide range of ecological, epidemiological, socio-economic and behavioral factors. Relevant studies highlight the complexity of this disease and the need for an integrated and multidisciplinary approach. These approaches must include vaccination strategies for domestic and wild animals, control of animal migration, especially of species that can carry the virus over long distances, international collaboration and the implementation of public health policies tailored to the region, and educational campaigns that raise awareness among communities. Only through such collaboration between the different sectors involved in public health, environmental protection and community education can the spread of rabies be effectively reduced and major outbreaks of infection prevented.

MATERIAL AND METHODS

This research is based on the indirect method of data collection, with the objective of analyzing the epidemiological situation of rabies in the Republic of Moldova for the years 2022-2024. The study is founded on the official data provided by the National Agency for Food Safety on the incidence of rabies on the territory of the country and follows a multidimensional and qualitative approach, using the inductive method. At the same time, the research has an exploratory nature, being supported by the analysis of specialized literature and relevant documents.

In this study, it was proposed to examine the correlations between various variables, such as the species affected, the localities where the cases were reported, their temporal distribution and the factors that could influence the occurrence of multiple cases in a given region. The analysis focused on identifying the relationships between species, location and frequency of rabies cases, in order to discover relevant patterns or trends that could contribute to the improvement of rabies prevention and control strategies in the Republic of Moldova.

RESULTS AND DISCUSSIONS

Understanding the spatial and temporal dynamics of rabies, including the species affected, the localities where cases have been reported and the factors influencing the occurrence and persistence of outbreaks, is essential for anticipating and controlling the spread of the disease into new geographic areas. The evolution of the rabies epidemic front is often irregular, influenced by the heterogeneous distribution of susceptible hosts, variations in local contact rates, sporadic transmission over long distances and the effectiveness of epidemiological surveillance measures (CRUZ, 2024).

The present study is a continuation of the evaluation and monitoring of the epidemiological situation of rabies in the Republic of Moldova, carried out systematically since 2012. Analysis of the data collected indicates that wildlife vaccination programs have had a significant impact in reducing the incidence of the disease (BALACCI & BĂLAN, 2022; BALACCI et al., 2022; BALACCI et al., 2024). The present study focuses on assessing the geographical and temporal distribution of rabies cases reported in the period 2022-2024, trying to identify spread trends and the determinants of the occurrence and maintenance of outbreaks.

The research uses epidemiological data collected during this period to highlight the patterns of rabies virus dispersal, its prevalence in various species and the influence of ecological and anthropogenic factors on disease dynamics. The study also aims to identify high-risk areas and emphasizes the need to implement more effective epidemiological control and surveillance measures to prevent the spread of the infection in the coming years.

This analysis is supposed to ensure an in-depth understanding of the mechanisms of rabies persistence, while also providing practical recommendations for reducing the incidence of rabies in the Republic of Moldova.

Data on infected animal species, seasonality of cases and localities where rabies outbreaks were recorded in 2022 are presented below (Table 1).

Table 1. Infected animal species, time of year and locality of registration of rabies cases for 2022.

No.	Species name	Time of year	Locality
1.	Cattle	03.03.2022	Falesti, Izvoare
2.	Dog	23.03.2022	Chisinau, Truseni
3.	Cattle	04.05.2022	Telenesti, Suhuluceni
4.	Cat	21.07.2022	Leova, Coporani
5.	Cattle	26.08.2022	Calarasi, Ursari
6.	Fox	05.09.2022	Slobozia, Parcani
7.	Dog	15.09.2022	Singerei, Biruinta
8.	Cattle	19.09.2022	Briceni, Marcauti
9.	Cattle	19.10.2022	Slobozia, Parcani
10.	Cattle	31.10.2022	Singerei, Tiplesti
11.	Cattle	31.10.2022	Singerei, Tiplesti
12.	Jackal	14.12.2022	Briceni, Criva
13.	Dog	27.12.2022	Briceni, Criva

The data in Table 1 show that, in 2022, 13 cases of rabies were detected in 5 species of animals. Of these, cattle were the most affected, accounting for 53.85% of all the cases. Dogs were the second most affected category, with 23.08% of the cases. Cats, foxes and jackals had a smaller share, each contributing 7.69% to the total number of the cases.

It is noted that the most affected species are cattle and dogs, which are also the most frequently reported as carriers of the rabies virus. This can be explained by the more frequent contacts of these animals with disease vectors, but also by their exposure to areas with intense circulation of rabies.

The geographical distribution of cases indicates a higher concentration of rabies in the northeast and center of the country, where the Briceni and Sîngerei districts recorded 3 cases each in a single year. There are also localized outbreaks, such as Țiplești, where 2 cases were reported on the same day, and Criva, where 2 cases were registered within 2 weeks, which represents 30.77% of the total cases registered in 2022. These situations may signal a possible concentration of the rabies virus in certain areas, justifying the need for increased control measures, such as epidemiological monitoring, preventive vaccination of animals and reduction of the wild vector population.

Next, the epidemiological situation of rabies for 2023 was analyzed. Data on the species of infected animals, the time of year and the locality of registration of rabies cases for 2023 are presented in Table 2.

Table 2 shows 24 cases of rabies recorded on the territory of the Republic of Moldova in 2023, affecting 6 animal species, namely dogs, cats, cattle, goats, foxes and martens. Their distribution throughout the year and in different localities allows the identification of relevant epidemiological trends.

Table 2. Infected animal species, time of year and locality of registration of rabies cases for 2023.

No.	Species name	Time of year	Locality
1.	Fox	23.01.2023	Tiraspol
2.	Dog	25.01.2023	Edinet, Hincauti
3.	Dog	26.01.2023	Edinet, Hincauti
4.	Cat	16.02.2023	Floresti,Cosernita
5.	Cattle	16.02.2023	Floresti, Domulgeni
6.	Dog	17.03.2023	Tiraspol, Slobozia
7.	Fox	17.03.2023	Tiraspol, Slobozia
8.	Dog	28.03.2023	Soroca, Baxani
9.	Dog	14.04.2023	Tiraspol, Grigoriopol
10.	Dog	16.05.2023	Tiraspol, Slobozia
11.	Marten	16.06.2023	Dubasari, Dubasari
12.	Cat	16.06.2023	Ocnita, Ocnita
13.	Dog	14.09.2023	Comrat, Comrat
14.	Cat	18.09.2023	Rezina, Sircova
15.	Dog	18.09.2023	Slobozia, Butor
16.	Cattle	20.09.2023	Edinet, Vanciucputi
17.	Cattle	20.10.2023	Camenca, Podoima
18.	Goat	20.10.2023	Camenca, Podoima
19.	Cattle	20.11.2023	Drochia, Suri
20.	Cattle	29.11.2023	Rezina, Solonceni
21.	Cat	08.12.2023	Tiraspol, Blijnii Hutor
22.	Dog	13.12.2023	Dubasari, Pohrebea
23.	Fox	26.12.2023	Edinet, Trinca
24.	Cattle	26.12.2023	Rezina, Piscaresti

Dogs are the most affected species, with 9 cases (37.50%), which highlights a high risk of rabies transmission to humans, given the frequency of their interaction with the population. Cattle, with 6 cases (25.00%), occupy the second position in the incidence, probably due to their frequent contacts with infected wildlife. Cats, reported in 4 cases (16.70%), suggest a significant role in rabies transmission, especially in rural areas. Foxes, involved in 3 cases (12.50%), confirm their status as a natural reservoir of the rabies virus. Martens and goats, each with one case (4.17%), indicate a possible accidental exposure, most likely through contact with other infected animals.

Analyzing the geographical distribution of the rabies cases, it can be seen that Edinet was the most affected district, with 4 cases reported in Hincăuți, Vanciucpuți and Trinca, which represents 16.67% of the total cases. Other localities with multiple cases include Rezina, with 3 cases (12.50%), and Floresti, with 2 cases (8.33%).

As regards the evolution of cases during the year, most cases were recorded in January and March, with 3 cases in each of these months. In June, 2 cases were reported, in September – 4 cases, suggesting increased vector activity during these periods. In December, 4 cases (16.67%) were reported as well, indicating a persistent risk even in the winter months.

Subsequently, the epidemiological situation of rabies for 2024 was studied. Data on the species of infected animals, the time of year and the locality of registration of rabies cases for 2024 are presented in Table 3.

Table 3. Infected animal species, time of year and locality of registration of rabies cases for 2024.

No.	Species name	Time of year	Locality
1.	Cat	23.01.2024	Floresti, Ghindesti
2.	Cattle	30.04.2024	Rezina, Tsaruca
3.	Dog	15.05.2024	Comrat, Cioc-Maidan
4.	Cattle	30.05.2024	Calarasi, Radeni
5.	Fox	21.06.2024	Anenii Noi, Speia
6.	Dog	16.07.2024	Comrat, Besalma
7.	Cattle	04.09.2024	Aneni Noi, Puhaceni
8.	Cattle	02.10.2024	Rezina, Echimauti
9.	Cat	04.10.2024	Slobozia, Frunze
10.	Cat	04.10.2024	Taraclia, Tvardita
11.	Goat	11.11.2024	Grigoriopol, Speia
12.	Cattle	26.11.2024	Calarasi, Sipoteni
13.	Dog	26.11.2024	Slobozia, Camenca
14.	Jackal	24.12.2024	Rezina, Rezina

15.	Cattle	13.12.2024	Calarasi, Calarasi
16.	Cattle	10.12.2024	Rezina, Lalova
17.	Cattle	09.12.2024	Anenii Noi, Cobusca Noua
18.	Cattle	05.12.2024	Floresti, Sanatauca

The data in Table 3 highlight 18 cases of rabies registered in 2024 in the Republic of Moldova, distributed to several animal species. Analyzing these cases, we can observe the distribution of the species of infected animals, the periods of the year and the localities where the rabies cases were reported.

Cattle with 9 cases (50.00%) are the most frequently affected, accounting for a significant share of the total rabies cases reported this year. The cases of rabies in cattle are distributed throughout the year with a concentration in the autumn and early winter months.

Dogs with 3 cases (16.67%) continue to be one of the species most exposed to rabies, being an important vector of rabies virus transmission. Similarly, cats recorded 3 cases (16.67%), which confirms them as a significant species in the rabies epidemiological chain. Goats, although less frequently affected, represented one case (5.56%), which indicates the risk of rabies exposure in regions where contact with wildlife is possible.

As for wildlife, foxes, with one case (5.56%), represent a natural reservoir of the virus, contributing to its spread in natural and rural areas. Jackals, with one case (5.56%), like foxes, are a wild species susceptible to rabies and can play an important role in maintaining and transmitting the virus in natural ecosystems.

The rabies cases were reported throughout the year, with an upward trend in the second half of the year. The cases in the spring (especially in April and May) are less common, but cases of rabies are starting to be recorded in southern localities, such as Comrat and Taraclia. The summer months (June and July) witnessed rarer cases of rabies, such as the fox case reported in June and the dog one - in July. The most numerous cases of rabies were recorded in November, 3 cases, which constitutes 16.67%, and December, 5 cases, which constitutes 27.78%, with a concentration of cases in cattle, which suggests a possible increased exposure of them to infected wild animals during this period.

Localities such as Rezina with 4 cases, Anenii Noi with 3 cases and Calarasi with 3 cases are the most affected districts in the Republic of Moldova in 2024. It is noted that the number of districts where multiple (repeated) cases of rabies are recorded is significant and constitutes 88.89% of cases. In these areas, domestic and wild animals can come into contact more frequently, which favors the spread of the disease. Floresti is the locality with the greatest diversity of affected species, with cases of rabies in cats and cattle. Rezina and Calarasi have consistently reported cases of rabies in cattle, indicating a significant risk of spread among farm animals in these regions.

The year 2024 was marked by a significant prevalence of rabies in cattle, which suggests that prevention and control measures must specifically target these species. Dogs and cats continue to be an important source of transmission, and wild animals, such as foxes, jackals, have also contributed to the spread of rabies. Close monitoring of outbreaks, as well as educating communities about the prevention of rabies in pets and wildlife, are essential for controlling this disease in the Republic of Moldova.

Comparing the distribution of rabies cases over the three years, a recurring pattern is observed: most cases occur in the autumn and early winter months. This could be explained by the increase in interaction between domestic and wild animals during this period. Also, every year, cattle and dogs were the most affected species, indicating their high vulnerability. Cases of rabies in cats are relatively constant, and foxes remain an important reservoir of the virus in the wild. A distinct aspect of 2023 is the high number of cases in dogs (9), suggesting an increased risk for transmission of the disease to humans. In contrast, in 2024, cattle (9) were the most affected, indicating their higher exposure to sources of infection.

In conclusion, the analyzed data suggest that rabies persists annually, having a seasonal distribution, with peaks of incidence in autumn and winter. Cattle, dogs and foxes remain the main affected species, which underlines the need for continuous measures to prevent and control the disease.

Next, we analyzed the geographical distribution of rabies cases on the territory of the Republic of Moldova for the years 2022-2024 (Fig.1).

From the data of Fig. 1, it is noted that in 2022, there were 13 cases of rabies, which were distributed concentratedly over a small area, especially in the center and northeast of the Republic of Moldova. Subsequently, the number of rabies cases in 2023 increased from 13 to 24, which represents an increase of 84.62% with the increase in the distribution area of the rabies virus and its movement to the northeast, conquering the entire territory of the right bank of the Dniester River. This increase may indicate an intensification of the circulation of the virus or better detection and reporting of the disease.

In 2024, with the decrease in the number of rabies cases compared to 2023 from 24 to 18 cases, which means a reduction of 25.00%, there was also a decrease in the territorial area infected by the rabies virus. This decrease may be the result of natural fluctuation in the incidence of the disease. Compared to 2022, there was an increase of 38.50% in 2024, which suggests that, although the situation has improved compared to 2023, the number of cases remains higher than in 2022.

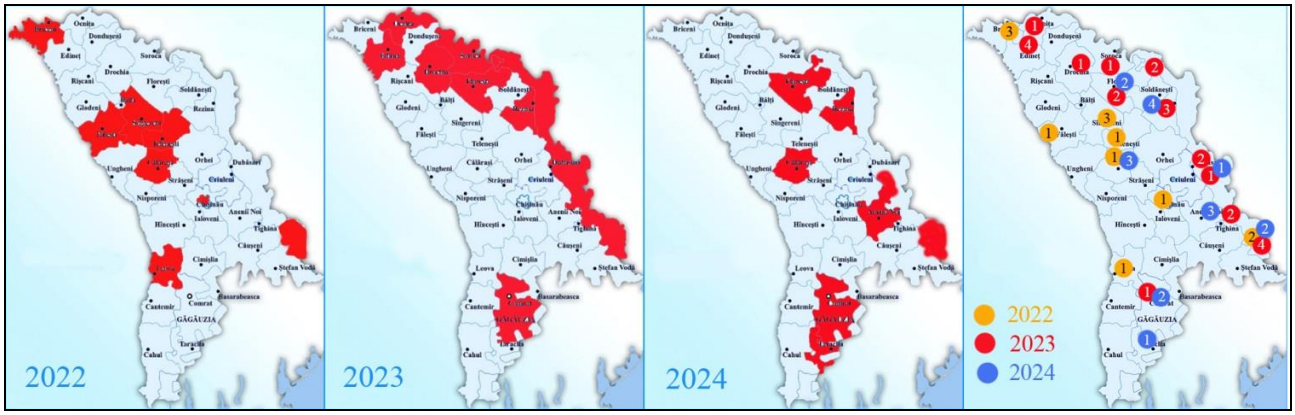

Figure 1. Distribution of rabies cases on the territory of the Republic of Moldova for 2022-2024.

Therefore, it can be concluded that during the study period, the rabies virus migrated from the central and northwestern regions of the Republic of Moldova (2022) to the eastern areas (2023), and later (2024) redistributed to the center of the country in the form of isolated outbreaks. It can also be seen that the Comrat region remains a high-risk area, with a constant incidence of rabies in the south of the Republic of Moldova.

Next, the monthly distribution of rabies cases was studied, the data are presented in Table 4.

Table 4. Monthly distribution of rabies cases for the years 2022-2024.

No.	Moon registration of the disease	Year of registration of the disease, head			Total illnesses over 3 years	
		2024	2023	2022	head	%
1.	January	1	3	-	4	7,27
2.	February	-	2	-	2	3,64
3.	March	-	3	2	5	9,10
4.	April	1	1	-	2	3,64
5.	May	2	1	1	4	7,27
6.	June	1	2	-	3	5,45
7.	July	1	-	1	2	3,64
8.	August	-	-	1	1	1,81
9.	September	1	4	3	8	14,55
10.	October	3	2	3	8	14,55
11.	November	3	2	-	5	9,10
12.	December	5	4	2	11	20,00
Total per year		18	24	13	55	100

Table 4 shows the distribution of rabies cases recorded over three years (2022–2024), highlighting the monthly distribution of illnesses and each month's percentage of total reported cases.

In 2022, the total number of rabies cases was 13 cases, which represents the lowest incidence among the three years analyzed. The cases were reported only in seven months of the year, which indicates an unequal distribution of diseases. It is noted that the highest incidence was recorded in the months of autumn, September and October, each with 3 cases, representing 46.16% of the total annual cases. In contrast, in the first two months of the year, no cases of rabies were reported.

In 2023, the total number of rabies cases was 24 cases, which represents the highest incidence among the three years analyzed. Compared to the previous year (2022), the number of cases almost doubled, indicating an increase in the circulation of the rabies virus. There is a more uniform distribution of illnesses throughout the year, without extended periods without cases, as observed in 2022. The most affected months were September and December, each with 4 cases (16.67% of the annual total). An increase in cases is also observed in the cold season (January, March, November and December), which indicates a seasonal influence on the spread of the virus. Compared to 2022, there is an increase in the number of cases in the first half of the year, which suggests a possible change in the epidemiological dynamics of the disease. This increase could be explained by ecological, epidemiological factors or by an intensification of diagnostic and case reporting efforts.

In 2024, the total number of rabies cases reported was 18 cases, representing a decrease compared to the previous year (2023), when 24 cases were registered, but still a higher value compared to 2022 (13 cases). This fluctuation may indicate a partial effectiveness of prevention measures, but also the maintenance of a significant epidemiological risk. It is noted that December was the most affected, registering 5 cases, which represents over a quarter (27.78%) of the annual total. This trend is similar to previous years, suggesting a possible seasonal peak during the cold period. Other months with a significant number of illnesses are October and November, each with 3 cases (16.67%), which indicates an increase in the incidence in late autumn and winter. Compared to 2023, the first half of

2024 saw fewer cases, which may be a sign of more effective disease control or less favorable ecological conditions for the spread of the virus. However, the persistence of cases in the winter months indicates the need to continue surveillance and vaccination measures, especially during periods of high risk.

In the 2022-2024 study period, a significant variation in the number of cases is observed throughout the year, with a higher incidence in the autumn and winter months. The highest share of illnesses was reported in December (20.00% of the total), followed by September and October (each with 14.55%). Also, a higher frequency of cases is recorded in March and November (9.10%), while the fewest cases were reported in August (1.81%). Looking at the trends by year, there is an increase in cases in 2023 compared to 2022, followed by a relative decrease in 2024. This dynamic may indicate seasonal fluctuations or the influence of epidemiological and ecological factors on the circulation of the rabies virus. This monthly distribution can be useful for implementing prevention and control measures, such as vaccinating animals and monitoring vector populations during periods of high risk.

CONCLUSIONS

During the three years of study (2022-2024), rabies infected various species of animals, with a higher prevalence among domestic animals (cattle, dogs, cats) than wild animals (foxes, jackals, martens). The geographical and temporal distribution of cases suggests a complex dynamics of the circulation of the virus, influenced by ecological and anthropogenic factors.

A significant aspect highlighted in the data analysis is the repeated concentration of cases in certain localities, such as Rezina, Briceni, Edinet and Slobozia. These regions have reported multiple rabies outbreaks, indicating sustained circulation of the virus, possibly favored by the increased density of domestic and wild animals, the proximity of their habitats and insufficient prevention measures.

Rezina (7) and Slobozia (8) stood out for the presence of cases in multiple species and over multiple years, which suggests an active reservoir of the virus in the local fauna. Similarly, in Briceni, cattle and dogs were among the most affected species, and their interaction with wildlife, including jackals, could explain the persistence of the outbreaks. Edinet (4) showed an increased incidence among dogs and cats, which underlines the importance of domestic animal population control and vaccination measures.

The temporal analysis highlighted an increase in cases during the months of August-December, a trend that may be associated with the intensification of interactions between domestic and wild animals during this period. Also, the registration of cases in the same localities at relatively short intervals indicates a persistence of the virus and a possible insufficiency of control and prevention measures.

Localities with a high density of domestic and wild animals, such as Briceni, Rezina, Edinet and Slobozia, are critical points for rabies transmission. The persistence of outbreaks in these areas underlines the need for more rigorous prevention measures, including stepping up vaccination campaigns, controlling the wildlife population especially in localities with frequent cases, and improving epidemiological monitoring for more effective management of the disease.

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Balacci Sergiu, Bălan Ion, Roșca Nicolae, Buzan Vladimir
Moldova State University, Institute of Physiology and Sanocreatology,
Academiei str., no.1, MD-2028, Chișinău, Republic of Moldova.
Technical University of Moldova, Stefan cel Mare blvd, no.168, MD-2004, Chișinău,
Republic of Moldova.
E-mail: sergiobalacci@gmail.com

Received: April 13, 2025
Accepted: August 7, 2025