

The Evolution of Peste des Petits Ruminants (PPR) in Romania and Neighbouring Countries

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Abstract

Peste des petits ruminants is a very serious viral disease that affects several species of small ruminants, both domestic and wild, highly contagious and with a very severe course, ending in death in 70-80%. The disease also causes significant economic losses in the livestock sector. On 19.07.2024, the first outbreak of peste des petits ruminants in Romania was confirmed. In August 2024, 56 outbreaks of peste des petits ruminants were confirmed in Romania in Tulcea, Constanța and Timiș counties. A total of 236,082 sheep and goats were killed, as a result of the measures instituted by the authorities. The first cases of the disease appeared on 11.07.2024, followed by deaths in the following days. Peste des petits ruminants also appeared in Greece, in goats and sheep kept in the municipal unit of Kalambaka, municipality of Meteora, in the regional unit of Trikala, region of Thessaly, which was confirmed on 11 July 2024. In 2018, among the countries closer to Romania, the disease was reported in Turkey, Georgia and, more recently, in Bulgaria. PPR is a highly contagious, transboundary disease associated with significant economic losses. Because they did not think about peste des petits ruminants, given that this virus had nowhere to appear, veterinarians suspected the development of some bacterial lung diseases exacerbated by the extremely high temperatures of this period. Only after 8 days, the virus was confirmed at the farm in Tulcea and, subsequently, at several farms in the county, after which it appeared, a few days later, absolutely mysteriously, in the farms in Constanța. Tens of thousands of animals were killed, and extensive areas were quarantined. In January 2025, the first outbreak of peste des petits ruminants was confirmed in Hungary, in the Laboratory of the National Office for Food Chain Safety (Nébih) in Zal County, being the first cases of sheep plague in this country, and the sanitary-veterinary authorities went on alert. Measures were also taken in Slovenia.

Key words: outbreaks, peste des petits ruminants, sheep plague.

1. Introduction

Peste des petits ruminants (PPR) is an infectious viral disease first mentioned in Ivory Coast, on the West African continent, in 1942. In the following years, the disease spread rapidly to other African countries, then encompassing Asia [1,2]. For a long time, this disease was difficult to describe due to confusion with other conditions, which its evolution favours. Under natural conditions, small

ruminants, especially goats, are susceptible to the disease, and it is sometimes possible for it to develop only in goats, without affecting sheep. The most susceptible to the disease were initially the Dwarf goat breeds from West Africa, generally affecting young animals between 3 and 18 months of age. The involvement of wildlife in the epidemiology of PPR is not fully elucidated. In recent years, the PPR virus has spread rapidly, covering increasingly large areas, especially in

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developing countries. Cases of the disease have also been reported in buffaloes, camels, and cattle with asymptomatic forms of the disease. Cases of the disease have also been recorded in wild herbivores on the African and Asian continents, such as gazelles and antelopes. The disease evolves epidemically, with morbidity of 80-90%, especially in humid and warm areas [3]. The etiological agent is the peste des petits ruminants' virus, classified in the *Paramyxoviridae* family, subfamily *Paramyxovirinae*, genus *Morbillivirus*, order *Mononegavirales*, which also includes: distemper virus, rinderpest virus, measles virus and marine mammal viruses, namely morbillivirus of cetaceans (dolphins, porpoises, whales) and distemper virus of seals. It is an RNA virus with a relatively low resistance to the action of physical and chemical agents, being destroyed in 60 minutes at 50°C, with a half-life of 2 hours at 37°C, destroyed by pH ≤ 4 or ≥ 11 , very sensitive to alcohol, phenol and most disinfectants, destroyed by 2% sodium hydroxide in 24 hours, refrigeration and freezing preserving it. The virus is fragile in the external environment and does not spread over long distances. It is destroyed by 60 minutes of exposure to temperatures above 50 degrees Celsius and inactivated at pH levels below 4.0 and above 11.0 (stable at pH 5.8-10.0). Refrigeration and freezing preserve the PPR virus. Ultraviolet light and desiccation have an inactivating effect within 3-4 days and it is sensitive to alcohol, phenolic compounds, sodium hydrate, sodium hypochlorite, citric acid, detergents and iodoform. The virus is more stable in a dry atmosphere than in a humid atmosphere, a phenomenon that leads to its persistence and circulation for a longer period of time. The virus can survive for long periods of time in refrigerated and frozen tissues [4,5]. Small ruminants, especially goats, are susceptible under natural conditions. Situations are frequent in which the disease develops in goats, without affecting sheep. In goats, the greatest sensitivity is shown by dwarf breeds from West Africa (Laguna breed, Kirdi, Djallonke, etc.), as well as young animals aged 3 to 18 months. Humans are not susceptible to this disease. Peste des petits ruminants is transmitted very easily, by direct contact, by animals in the incubation period or already sick. In the early stages of infection, all secretions (ocular, oral, nasal) and excretions (faeces) are contaminated with the virus. Also, when the disease progresses further, it can be transmitted through milk.

Secretions eliminated by coughing and sneezing of sick animals form virulent aerosols in the air that end up being inhaled by healthy animals, especially in the case of those kept in close cohabitation. Spread through aerosols over long distances is unlikely. At low temperatures and darkness, the virus manages to reach a distance of about 10 meters. The virus can survive in faeces for up to 11-12 weeks in healthy dwarf goats. Transmission of the infection is mainly by direct contact from the sick animal to the susceptible one and is unlikely to be indirect, given the low resistance of the virus in the external environment with a mortality rate in infected animals that can reach 70%, sometimes higher. There is a general lack of evidence regarding the survival of PPR in raw meat and milk [6]. The virus enters the body at the level of the nasopharyngeal mucosa. Secondary sources include: feed, bedding and other materials, which the virus can survive and transmit it for a short period, but do not remain infectious for a longer period of time. There is no vertical transmission of PPR through the placenta.

The epidemiology of this disease has recorded seasonal variations, being more frequent in rainy or cold and dry periods. Often, epidemic outbreaks occur in the form of cycles that follow each other at intervals of 4 to 5 years, which correspond to the reconstitution of susceptible populations. In the case of peste des petits ruminants, the clinical signs fall into super-acute, acute, subacute and chronic evolutions. The difference is mainly given by the virulence of the virus [7,8]. The incubation period is 21 days. Among the main symptoms of peste des petits ruminants are: high fever, over 40 degrees Celsius, anorexia, serious ocular and nasal secretions that evolve into mucopurulent secretions, necrotic lesions in the oral cavity, diarrhoea with blood and mucus (after 3-4 days), dyspnoea and cough, death (usually one week after the onset of the disease). In severe outbreaks, morbidity rates can reach 90-100%, with 100% mortality, while in less severe outbreaks, morbidity does not exceed 50%. Both morbidity and mortality are lower in endemic areas and in adult animals compared to young ones. In some cases, the disease may be asymptomatic.

2. Peste des petits ruminants in Europe

For many years, peste des petits ruminants was reported only in some countries in Africa (between

the Sahara and the Equator), Southeast Asia (especially in India), Central Asia, the Middle East, and the Arabian Peninsula. The use of an attenuated vaccine to combat PPR in small ruminants until 1990 may have slowed the genetic evolution of the virus, limiting its genetic variability and potential for spread. In the last 15 years, PMR has spread rapidly, expanding to other areas of Africa and large parts of Asia, as well as Europe. The first outbreaks of PPR in Europe were reported in 2000 in Istanbul, originating from the Thrace region, Turkey, and in February 2016 in Georgia, on a sheep farm in the Tbilisi region [9,10]. In June 2018, an outbreak of PPR was reported in Bulgaria 10 km from the Turkish border, in three flocks of sheep and goats in the Yambol region. Another outbreak of PPR was discovered in Georgia, confirmed in March 2024. On 11 July 2024, in the Trikala regional unit, Thessaly region, Greece, an outbreak of PPR was confirmed for the first time, confirmed by the Greek National Reference Laboratory in a holding of 264 sheep and goats, the flock of which first developed signs of disease at the end of June [10]. It was subsequently reported for the first time in Romania on 19 July 2024 [11,12]. In the event of the disease occurring in free countries, stamping-out is used. In countries where the disease frequently occurs, sick animals are isolated and, if necessary, treated with antibiotics to prevent secondary bacterial infections or are slaughtered. Disinfection and vaccination of healthy animals are applied. In Greece, PPR was initially suspected due to clinical signs reported in animals from the infected herd. These clinical signs included high fever, dyspnoea, conjunctivitis, nasal discharge and necrotic stomatitis with halitosis. The samples were tested for PPR virus and were found to be negative. Due to the negative results obtained, new samples were taken from the affected herd on 8 July of the same year to test for PPR and other similar diseases. The results were found to be positive for PPR virus by real-time reverse transcription polymerase chain reaction (RT-PCR). In the first outbreak in Greece, 50 deaths were recorded from a herd of 264 infected small ruminants. From this initial outbreak, approximately 8 000 animals were slaughtered and over 200 000 animals were tested for PPR. As of 13 September 2024, 71 outbreaks have been confirmed in the regions of Attica, Crete, Ionian Islands, Macedonia, Messinia, Central Greece, Western Thessaly, Peloponnese and Thrace. In

accordance with Commission Delegated Regulation (EU) 2020/687 and the National Emergency Plan no. 1747/386028/2023, all measures for the control of the outbreak were implemented, namely: the establishment of protection and surveillance zones, the total elimination of animals from infected herds, the slaughter of all animals from the infected herd (stamping-out) with the destruction of their carcasses, the prohibition of the free movement of live animals, the control of the movement of live animals and products from sheep and goats in areas outside the regional unit, the cleaning and disinfection of affected farms, the application of biosecurity measures and the surveillance of all sheep and goat herds in the established areas. On 25 November 2024, an outbreak was reported in Bulgaria, in five locations, which in fact represent a single epidemiological unit, belonging to a single family, with shepherds and common pastures. Out of 1,769 sheep, 25 cases were detected and four deaths were recorded. All necessary control measures were applied. In January 2025, an outbreak of Peste des Petits Ruminants (PPR) was detected for the first time in Hungary, in the Zala County, Szentgyörgyvölgy village, located close to the Hungarian-Slovenian border. It was a sheep farm, as reported by the Hungarian veterinary services [13,14,15]. On February 28, 2025, the export of live sheep and goats to the Member States of the European Union was suspended after a case of Peste des Petits Ruminants was detected in Austria from sheep coming from Romania. The export of carcasses is not affected [16,17].

3. Peste des petits ruminants in Romania

Our country has the second largest number of live sheep raised in the European Union, after Spain, according to Eurostat data. In December last year, there were almost 10.36 million live sheep in Romania, slightly up on the previous year and over 3 million fewer than in Spain, preliminary figures show. Romania holds almost 23% of the EU sheep meat consumption market. The only sector in which Romania held first place in Europe was sheep export, practiced in Arab countries, managing to open three new markets in Morocco, Algeria and Turkey, in addition to Jordan, Saudi Arabia, Israel, Lebanon, Libya and Kuwait in 2024. Farmers had already prepared 4 million heads to leave for the East and North Africa. A deadly and

contagious virus appeared, almost at the same time, in the largest sheep farms in Tulcea and Constanța, although the virus did not exist in Europe, except for a brief episode in Bulgaria in 2018. The first cases of illness appeared on 11.07.2024, followed by deaths in the following days [18]. Because they did not think about peste des petits ruminants, given that there was nowhere for this virus to appear, veterinarians suspected the evolution of some bacterial lung diseases exacerbated by the extremely high temperatures of this period [19]. Only after 8 days, the virus was confirmed at the farm in Tulcea and, subsequently, at several farms in the county, after which it appeared, a few days later, absolutely mysteriously, also in the farms in Constanța. Tens of thousands of animals were killed, and extensive areas were quarantined. What is more serious is the fact that it is not known how this disease reached sheep in Romania. It is a viral infection specific to the African continent. In fact, it was first described in 1942, based on tests carried out on small ruminants in the Ivory Coast. The disease subsequently spread very quickly to countries in Africa and Asia. This disease is characteristic of areas in Africa, the Middle East and South India. Investigations have been carried out at European and national levels and it is suspected that the fault lies either with negligence, or with the Romanian control authorities, or with those in the country from which the contaminated batch left, or with all of them. It is also assumed that this is a large shipment that entered Romania more or less controlled or about the purchase by owners of certain breeding animals that were not examined upon departure from that country [20]. The first outbreak of PPR in Romania was detected on 11 July 2024 in a sheep fattening farm in Tulcea, near the Black Sea coast, and reported by the World Organization for Animal Health (WOAH) on 20 July 2024 (Table 1). There were 2,028 cases and deaths in a flock of 51,119 sheep. The origin of the introduction is unknown or uncertain at this stage. A total of 236,082 sheep and goats were killed as a result of the measures instituted by the authorities. As of September 9, 47 outbreaks of peste des petits ruminants (PPR) were still active in Romania out of the 64 confirmed at national level [21]. Thus, 17 outbreaks were extinguished, of which ten PPR outbreaks – in Tulcea County, 6 PPR outbreaks in Constanța County and one PPR outbreak in Ialomița County. In mid-August, Romania still had 37 active outbreaks of peste des petits ruminants,

after 30 outbreaks were extinguished in recent weeks - 21 in Tulcea County, eight in Constanța County and one in Ialomița County, according to a press release sent by the National Sanitary, Veterinary and Food Safety Authority. According to ANSVSA, at the beginning of October, Romania had 7 active outbreaks of peste des petits ruminants in Timiș County, after the last outbreaks in Tulcea County were extinguished. On 5 March 2025, following the confirmation of an outbreak of peste des petits ruminants in Gepiu, Bihor County, restriction zones (protection, surveillance and supplementary) were established to limit the spread of the disease. Thus, the restrictions apply exclusively to the transport of live animals from Bihor and Arad counties to other Member States of the European Union [22,23,24]. This measure does not affect the entire country and does not impose a general interdict on the export of sheep and goats. The veterinary health alert completely blocks the activity of sheep and goat breeders in Arad and Bihor counties, even during the peak period for shepherds. Locals in the west of the country who want to buy lambs will be able to do so directly from farms. The solution is not to the farmers' liking, however. Because profits do not come from the domestic market, but from export. Because they cannot sell the animals, but they cannot take them out to pasture either, farmers expect increasing expenses. The movement restriction in Arad and Bihor remains in force until June 8. Four veterinary health alerts are currently in force in the west of the country. In addition to peste des petits ruminants, swine fever also remains, and in Hungary, foot-and-mouth disease and avian influenza. The detection of the PPR outbreak led the European Union to block live sheep exports within the EU. However, the restrictions do not apply to carcasses or cuts of meat. The interdict on cross-border sales and its limitations are important because export prices also dictate prices on the domestic market, said a livestock breeder representative [25]. Romania has always been an important supplier of live sheep to the Middle East. However, exports of processed lamb remain limited, due to low domestic processing capacity and low demand for chilled meat from trading partners. Although this type of export is not restricted by EU regulations, it fails to compensate for the losses caused by the ban on live animal trade. Even though farmers can export carcasses, meat, and animal products, the ban still has an economic impact. This apparent

price stability is supported by the oversupply of the domestic market, driven by restrictions on the export of live sheep to the European Union. The redirection of production to the domestic market has put downward pressure on prices. However, the risk of further outbreaks of PPR may affect slaughter and distribution capacity, which could lead to tensions in the supply chain. Consumers may benefit from short-term stability, but farmers continue to face significant economic pressures. Numerous countries, including Greece, Albania, Russia, Croatia, Serbia and Saudi Arabia, have suspended imports of live animals from Romania, which has had a devastating impact on the Romanian livestock industry and exporters. Specialists warn of a possible economic disaster in Romania if the state does not get involved by imposing measures to limit outbreaks and stop the evolution of the disease. This viral disease already affects a very large number of sheep and goats, risking huge losses in the Romanian livestock industry, with multiple implications. Given that Romania ranks second in the European Union in terms of the number of sheep, the economic implications, in the context of the spread of the plague, could be catastrophic. In fact, one of the main branches of Romanian animal husbandry will be affected, with multiple implications for Romanian society and economy. Some specialists accuse and say that this disease entered Romania due to negligence and the lack of import-export protection measures [26,27,28]. In the epidemiological conditions of Romania regarding peste des petits ruminants, it is necessary for the state to get involved and the export of sheep must remain open, green light must be prepared, and ANSVSA (National Sanitary Veterinary and Food Safety Authority) is committed to supporting the

development of sheep exports, including by renegotiating export conditions with third countries and by establishing an additional system for testing batches of animals intended for export. The latter can be carried out through ANSVSA laboratories that have the necessary equipment and expertise. Many assumptions are made regarding the emergence of PPR in Romania, some even being alleged deliberate acts to infect animals in our country. The main possible routes of introduction of PPR into free areas, the introduction of infected animals is by far the most efficient route of introduction of PPR into a country. In the EU, this could occur through the illegal transport of infected animals. In addition, PPRV can be introduced into the EU via infected animal products, particularly when transported illegally or intentionally to spread the virus (e.g. bioterrorism), although the risk of this occurring is low and it is unlikely that PPRV will spread further via this route. Of less importance is the introduction of PPRV via fomites (inanimate objects that can carry and spread diseases and infectious agents) into the EU, which is considered unlikely. This can occur when vehicles transporting animals return to the EU after delivering animals to infected areas or farms where biosecurity measures are not in place. The movement of live animals from third countries in the Mediterranean basin and Black Sea areas into the EU is currently prohibited, under EU animal health legislation on the import of live animals from countries where PPR is endemic. However, illegal movements of animals cannot be quantified. The illegal movement of animal products, including meat products, carried by tourists and visitors from countries with a high risk of PPR and transmissible animal diseases is large and underestimated [16].

Table 1. Evolution of PPR outbreaks in Romania [31]

Date	Number of outbreaks	Location (County)
11.07.2024	1	Tulcea
24.07.2024	5	Tulcea, Constanța Ialomița
27.07.2024	11	Tulcea
07.08.2024	56	Tulcea, Constanța, Brăila, Ialomița and Timiș
08.10.2024	17	Tulcea
05.03.2025	1	Bihor

4. Immuno-prophylaxis in peste des petits ruminants

In order to apply a vaccination program in the case of PPR, several factors must be taken into account:

the risk of the disease cannot be quickly eliminated by other methods, except for vaccinating the healthy ruminant population, the epidemiology, incidence, prevalence of the disease, the likelihood of rapid spread of the pathogen and consequently,

the export ban, the population density of small ruminants exposed to the disease, the habit of transhumance, amplified by the lack of pastures (devastating drought) and the need to find new places for grazing. A vaccination program is a good alternative, correlated with other disease control measures. We need to have a safe and effective vaccine available and a cost-benefit analysis of a vaccination program must be carried out. According to the World Organisation for Animal Health (WOAH), several vaccination strategies can be used, alone or in combination, based on the epidemiology and geographical characteristics of the disease occurrence [2]. A first strategy would be barrier vaccination, which means vaccination in an area along the border of an infected country or area to prevent the spread of infection to or from a neighbouring country or area. A second strategy is general vaccination, which means vaccinating all susceptible animals in an area or country. The third strategy variant consists of ring vaccination, which is the vaccination of all susceptible animals in a delimited area around the location of an outbreak. The last option would be targeted vaccination, which is the vaccination of a subpopulation of susceptible animals. Vaccination was implemented in Georgia after the first occurrence of PPR in 2016. In Turkey, vaccination was carried out but ceased in Thrace after the region was granted a “PPR protected zone” classification in March 2021. This measure, together with strict restrictions on the movement of live SR from Anatolia to Thrace, aimed to enforce the WOAH zonal freedom in Thrace. 2023. In Anatolia, PPR vaccines were applied to all SR newborns and unvaccinated adults [32]. The World Organisation for Animal Health (WOAH) recommends that veterinary services in countries affected by PPR take the following measures: effectively informing farmers, veterinarians and other professionals who come into contact with susceptible animals about the early detection of the disease, based on clinical signs. Also, the risk assessment and the mode of spread of the disease will be carried out, emergency plans will be updated, timely notification of the occurrence of the disease, therefore, there is transparency in communication and notification to other organizations and countries in case of the occurrence of the disease [11]. There is also an emphasis on regional collaboration and effective collaboration between affected countries for actions to limit outbreaks and avoid the cross-

border spread of PPR [33,34]. WOAH has also established a bank of effective PPR vaccines to facilitate rapid access to high-quality vaccines, under negotiated conditions, for the eradication of the disease in affected countries, to protect livestock industries and the livelihoods of those who depend on them [35,36].

5. Conclusions

The first outbreak of PPR in Romania was confirmed on July 19, at a commercial farm with 49,091 sheep in Baia, Tulcea County, but the first cases of the disease appeared as early as July 11. In mid-August, 60 outbreaks of peste des petits ruminants were detected. The most outbreaks (49) were discovered in Tulcea, with a total of over 230,000 sheep being killed to eradicate the disease. A deadly virus that does not exist in Europe, except for a short episode in Bulgaria in 2018, has emerged and spread precisely in the large exporting farms in our country, from Tulcea and Constanța county, then arriving in a county far from these two, namely Timiș county. Romania is facing a growing crisis in the livestock sector, generated by the spread of PPR and the controversy over the export of live animals.

Numerous countries have suspended imports of live animals from Romania, which has had a devastating impact on the Romanian livestock industry and exporters. Due to the peste des petits ruminants (PPR), the European Commission has decided to limit imports and exports until June.

The main possible routes of introduction of PPR into free areas, the introduction of infected animals is by far the most efficient route of introduction of PPR into a country. In the EU, this could occur through the illegal transport of infected animals. In addition, PPRV can be introduced into the EU via infected animal products, particularly when transported illegally or intentionally to spread the virus (e.g. bioterrorism), although the risk of this occurring is low and it is unlikely that PPRV will spread further via this route. Of less importance is the introduction of PPRV via fomites (inanimate objects that can carry and spread diseases and infectious agents) into the EU, which is considered unlikely.

Farmers in areas affected by peste des petits ruminants can request during this period the temporary authorization of slaughter points at the farm level, while respecting strict hygiene and animal welfare conditions. According to ANSVSA,

slaughtered animals will be able to be sold, under control, for example at the farm gate or through direct sale. These are measures intended to support farmers and allow the valorisation of local production, without compromising the biosecurity measures necessary to stop the spread of the disease.

It is absolutely necessary to make more investments in Romanian animal husbandry precisely so that animals are better controlled sanitary-veterinary, have better quality, and everything that enters the country is thoroughly checked and tested. In addition, funds should be allocated to support the establishment of breeding and production farms, for the maintenance, selection and improvement of native breeds.

Sheep exports must remain open, green light must be prepared, and the ANSVSA (National Sanitary Veterinary and Food Safety Authority) is committed to supporting the development of sheep exports, including by renegotiating export conditions with third countries and by establishing an additional system for testing animal batches intended for export. The latter can be carried out through the ANSVSA laboratories that have the necessary equipment and expertise.

Representatives of the ANSVSA assured the economic operators present of the provision of compensation for the affected animals, subject to compliance with legal provisions.

The year 2025 was not without events related to the evolution of PPR in Romania: a new outbreak occurred in Bihor County. This outbreak represents a recurrence of infection with the peste des petits ruminants' virus in the respective Member State, since the last outbreak of the disease in Romania, which was reported on 4 September 2024, although it is the first outbreak ever reported in Bihor County. This outbreak was confirmed on 5 March 2025, and a restricted area was established, comprising a protection zone, a surveillance zone and an additional restricted area, where additional disease control measures are applied, according to EU Implementing Decision 525/2025, adopted on 14 March and published in the Official Journal of the European Union on Monday, 17 March.

Although peste des petits ruminants does not affect humans, as there is no risk of disease, it still has a major social and economic impact.

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