



*Review*

## PASTEURELLOSIS AND EIMERIOSIS – WORLDWIDE PROBLEMS IN THE RABBIT FARMS: A REVIEW

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### ABSTRACT

There are different reasons for the emerging problems in the rabbitries not only globally, but also in Bulgaria, where the main problem is the economic instability. The high cost of veterinary products and poor veterinary care lead to difficult maintaining of the rabbitries. This leads to restriction of the prophylaxis and emergence of different diseases, which further the costs of the rabbitries owners. The aim of this article is to present main characteristics of two of the current and economically important diseases in the rabbits, namely pasteurellosis and eimeriosis (coccidiosis).

**Key words:** current diseases; *Pasteurella multocida*; *Eimeria stiedae*, infection.

### INTRODUCTION

In recent years there has been an increase in rabbit production as a source of protein. The consumers prefer the rabbit meat because of the low cholesterol and fat content (1, 2). Except preferred source of meat, the rabbits play an important role in various medical studies, and also can be grown as pets (3, 2).

Keeping these animals commercially, scientifically or socially requires regular veterinary prophylactic measures that are rare or not done in Bulgaria. This leads to the occurrence of various diseases that are difficult to treat or fatal. The treatment of a diseases in rabbits is difficult and costly for the owners.

Pasteurellosis and Eimeriosis are major problems, concerning the health management of a lot of rabbit farms. Therefore, the farmers must observed for their emergence and also to carry out a strict prophylaxis of these two diseases. The aim of this article was to show that despite the efforts to “discharge” the farms

from these nosological units, the factors that determine their occurrence are with different nature, and consequently the diseases are still current and today.

### THE RABBITRY AND RELATED PROBLEMS

Bulgaria offers appropriate conditions for development of industrial rabbit farming, however, still a large proportion of rabbits are grown in the private yard. The poor designing of the farms, namely the one-storey layout of the cells, does not allow the intensive use of the nests (4). Another problem is the weaning of the young rabbits, which is done at different ages, depending on the breed. During in this period (up to about 30 days after birth) (4), they are extremely susceptible to various diseases, which can reduce the number of the animals at a very early age. This in turn leads to decrease in the number of rabbits in a farm, which may be is the reason for the increase in the number of the female rabbits (4), in order to balance the losses. However, this increase of females leads to higher number of the common number of animals in the farm, and along with that to higher consumption of food and consequently to more money for fodder.

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The veterinary activities, including the prevention of diseases such as pasteurellosis, coccidiosis, myxomatosis, hemorrhagic disease are another major problem in the rabbit farms. The data provided by Grigorov (4), show that the owners of rabbitries are dissatisfied with the veterinary service and the cost of medicines.

Expensive prophylaxis of the diseases lead to missing or selective one (individual diseases) on the part of farmers, especially in small farms and private yards. This leads to the stationarity of the diseases and their frequent occurrence. One of the most common is also the subject of this article, namely pasteurellosis and eimeriosis.

The expansion of rabbits not only in our country but also globally, necessarily leads to the manifestation of various pathologies of infectious or non-infectious nature. In order to improve the health status of animals, different

methods for the diagnostics of these diseases are developed and used.

In a **Table 1** are presented the most common rabbit diseases with their basic characteristics. The information presents not only the pasteurellosis and eimeriosis as an important diseases in rabbit. Except these pathologies, there are and two other with immense importance for the rabbitries. The myxomatosis and the hemorrhagic disease lead to high mortality in rabbits and along with pasteurellosis and eimeriosis are subjects of research, concerning their prevention and treatment. The diseases in the table are the most common in the farms and may be appear on the same farm and lead to death of a large number of animals and therefore, to closing the farm. The table shows that the problems of the rabbitries are serious and their restriction is very difficult. The presented information is systematized and therefore, could be used by the rabbit owners when some of these diseases appeared.

**Table 1.** Current diseases in rabbits.

Disease	Eimeriosis (Coccidiosis)	Hemorrhagic disease	Myxomatosis	Pasteurellosis
Causative agent	Intracellular parasites – genus <i>Eimeria</i>	Rabbit hemorrhagic disease virus (RHDV)	Myxoma virus (MV) - genus <i>Leporipoxvirus</i>	G <sup>-</sup> bacteria <i>P. multocida</i>
Clinical signs	Weight loss, severe diarrhea with blood or mucus, weakness, abdominal pain (59, 53)	Apathy, anorexia, congestion of conjunctiva, prostration, most often death (62)	Blepharoconjunctivitis, swelling of the muzzle and anogenital region, febrile, often death (64)	Rhinitis, chronic bronchopneumonia; conjunctivitis, otitis media, localized abscessation, genital infections, acute septicemic pasteurellosis (2, 14)
Diagnosis	ELISA (50), oocyst determination using McMaster method (60, 53), histopathological (53), clinical signs (52), acute phase proteins determination (52, 49,	RT-PCR, ELISA, histopathology, immunohistochemistry (62)	PCR, ELISA, immunoblot (63)	Bacteriological, ELISA (19) immunohistochemically (18); immunoblot, polyacrylamide gel electrophoresis (15)
Treatment	Toltrazuril (52), ivermectin for treatment of intestinal coccidial infection (61, 52)	No treatment	Antibiotics, warm environment, non-steroidal analgetics (65)	Antibiotic treatment – Enrofloxacin, Ciprofloxacin, Gentamicin, Ofloxacin, Doxycycline, Chloramphenicol, Nalidixic acid (20)
Prophylaxis	Anticoccidial drugs, vaccination (59)	Vaccination (63)	Vaccination (63)	Vaccination, which do not give complete protection (66, 67)

**Pasteurellosis**

The pasteurellosis is a widespread infectious disease affecting a large number of animal species. The disease affects ruminants (5-11),

chickens (12, 13,), rabbits (14-20), swine (21) and others.

The pasteurellosis causes major damage to the affected farms as it often passes into a chronic disease that is periodically occurring. The causative agent of the disease is the Gram negative (G<sup>-</sup>) bacteria *Pasteurella multocida*, a commensal microorganism, a resident of the respiratory tract of the animals, which in practice makes it impossible to remove the pathogen.

The presence of predisposing factors (high humidity in the room, draft, cold), which reduce the resistance of the animals, contribute to the onset of the disease. In pigs the disease may occur as a complication after a bacterial or viral infection (21), which weakens the body's defense. The disease occurs with the clinical signs characteristic of the affected system: sneezing, nasal discharge (in some animals they are bloody), etc.

In rabbits, the disease can occur with the appearance of rhinitis with purulent nasal discharge, pneumonia, middle ear inflammation, pyometra, orchitis, abscesses, conjunctivitis and septicemia (22). The rabbits can be infected with the *P. multocida* pathogen immediately after birth as the number of bacteria increases with age to about 5 months (23, 20). This makes young, growing rabbits the most susceptible to infection group.

#### Virulent factors of *P. multocida*

The detailed study of the pathogenic factors of the microorganism is the basis of the modern methods of diagnostic and treatment of pasteurellosis.

Among these virulence factors (24), includes the polysaccharide capsule, endotoxins or lipopolysaccharides (LPS), outer membrane proteins, fimbriae and adhesins, exotoxins, extracellular enzymes, plasmids, multocidin. These factors have different functions relating to the viability and pathogenicity of *P. multocida*.

There are different sources of information, concerning the role of the pathogen factors, because they are of interest to scientists. The polysaccharide capsule is involved in the serotyping of the bacteria (24) and this determines the different pathogenicity of the serotypes in animals. The endotoxins or so-called lipopolysaccharides (LPS) promote adhesion to neutrophils and transmigration through endothelial cells (25, 26). External

membrane proteins contribute to the resistance of the bacteria to phagocytosis and have immunological characteristics (27, 28). The fimbriae and adhesins are involved in the process of attaching the microorganism to the host's respiratory epithelium. The multocidin binds and transports the iron required for bacterial growth. The plasmids determine the antibiotic resistance of the pathogen (24).

Except the aforementioned pathogen factors of *P. multocida*, the weaning of the rabbit is the other reason leading their dead. According to previous research (25) weaning should be 28 days after birth and could reduce the disease-causing agents *Pasteurella* and also *Escherichia coli*, which along with the *Pasteurella* is important pathogen for this species.

#### Diagnosis of the Pasteurellosis

The examined data showed that there are developed modern methods of diagnosing of this disease. These methods (ELISA, electrophoresis, immunoblot, PCR), which are based on the pathophysiological and genetic features of *P. multocida* (21, 15, 19, 20) are expensive and therefore rarely used. Also, pasteurellosis could be diagnosed on the basis of a clinical manifestation, although the clinical signs are not so specific (30) and may accompany other pathology. Therefore, this requires the use of a bacteriological test to confirm the disease, which is expensive and also slows the diagnosis.

There is data (31-34) concerning the use determination of one special group proteins - acute phase proteins as an alternative, fast and inexpensive way of early diagnosis of various diseases in rabbits. Therefore, the owners will have time to take the appropriate measures to prevent the occurrence of pasteurellosis.

#### **Eimeriosis**

##### What is Eimeriosis?

Rabbit eimeriosis (coccidiosis) is an intracellular parasitic disease caused by a variety of *Eimeria* genera (35-37). Until now, there are found 15 species, divided into two groups, depending on the site of the invasion: intestinal and hepatic (**Table 2**). From the previously described members of the genus, only one (*E. stiedae*) parasite's in the epithelial cells of the bile ducts of the liver (38, 2), others parasite in the host's small intestine (39).

**Table 2.** *Eimeria* species in the rabbits.

Species	Localization	Pathogenicity
<i>E. coecicola</i>	Appendix, sacculus rotundus, Peyer's pathes (68, 69, 59)	Non-pathogenic (70, 59)
<i>E. exigua</i>	Duodenum-ileum (71,59)	Slightly pathogenic (70, 59)
<i>E. flavescens</i>	Small intestine, caecum (72, 73, 74, 59)	Highly pathogenic (70, 59)
<i>E. intestinalis</i>	Lower jejunum and ileum (75, 59)	Highly pathogenic (70, 59)
<i>E. magna</i>	Jejunum and ileum, in a lesser extent duodenum (76, 77, 59)	Mildly pathogenic (70, 59)
<i>E. media</i>	Duodenum-jejunum, ileum (78, 59)	Mildly pathogenic (70, 59)
<i>E. perforans</i>	Duodenum, jejunum and ileum (79, 59)	Slightly pathogenic (70, 59)
<i>E. piriformis</i>	Colon (80, 59)	Mildly pathogenic (70, 59)
<i>E. stiedae</i>	Liver (81, 59)	Highly pathogenic (70, 59)
<i>E. vejovskyi</i>	Ileum (82, 59)	Slightly pathogenic (70, 59)
<i>E. irresidua</i>	Jejunum and ileum (72, 59)	Mildly pathogenic (70, 59)

The disease mainly affects young rabbits, but infected adults become carriers of the disease and a source of infection. The disease is most common in rabbits in farms where sanitary measures are low (36). The raises of this rabbit disease (35, 38, 40, 41) due to the economic losses and requires development of methods aimed its limitation, diagnosis and treatment. Therefore, there are the studies concerning development (42, 36, 41) and distribution (39, 37, 43) of the various representatives of the genus *Eimeria*; the clinicopathological (44, 2, 45); immunological and pathophysiological changes during the disease (46-49); diagnostics (50); prevention and treatment of the coccidiosis (51-53).

#### *E. stiedae*

The available information concerning rabbit coccidiosis showed that has been a lot of studies, which are made for the diagnostic, prevention and control of this disease. However, these studies are mainly for the intestinal species and the studies related to hepatic eimeriosis are few. The intestinal and hepatic coccidiosis often occurs as a mixed invasion and it is difficult to differentiate them on the basis of clinical signs. The transhepatic migration of the sporozoites of *E. stiedae* inevitably leads to changes in liver function. Moreover, the protozoan parasites have a pore-forming proteins (PFPs), leading to lysis of the target host cells (54). Perhaps this virulent factor and bile ducts localization determine *E. stiedae* amongst the highly pathogenic species in rabbits.

#### Eimeriosis and the other animals

The coccidiosis is a problem affecting not only rabbits, but also others animal species with

serious production losses. In accordance to rabbits and other adolescent animals could be infected, such as goats (55) and chickens (56-58). Thus, this intracellular disease becomes a problem of animal husbandry, because of the stationarity of these pathogens and also, the contact between the animals.

#### Diagnostic tests and prevention

The studies which are made to limit the eimeriosis, cover various aspects of the disease. The available data concerning the rabbit coccidiosis is primarily related with the clinical and post mortem research, however, it is not enough effective for the owners. Despite the disease is at an advanced stage and treatment is possible, the meat is not fit for consumption and must be discarded, leading to trade losses. The modern rabbit industry imposes introducing of the accurate and quick methods for diagnostic of eimeriosis, which are cheap, fast and reliable. In this way the rabbit owners and also the veterinarians could restrict the disease in the rabbitries. The reasonable decisions concerning eimeriosis are in the root of one healthy rabbitry.

The data in this article, regarding to rabbit diseases are very discouraging. The situation in Bulgaria's rabbitries is determined by the virulent factors of the pathogens from one side and the farming and poor awareness of the workers from the other side. Consequently, there are very important points, which must be fulfilled for better work of the farms.

#### **RECOMMENDATIONS TO PRACTICE**

The evidences presented in the article shows that the multiplicity of the described diseases implies their difficult restraint. The collected

facts can serve as a basis for the preparation of several points to help the prevention of the rabbit pasteurellosis and eimeriosis. On the basis of the text in the article can be made some recommendations to the practitioners concerning the described diseases:

- maintaining optimal zoo-hygienic conditions and disinfecting the premises;
- better awareness of workers about pasteurellosis and eimeriosis;
- adherence to prophylactic veterinary measures for rabbit diseases;
- screening tests for determination of the subclinical manifestations of pasteurellosis and eimeriosis;
- isolation of the diseased rabbits and sampling for typing of the pathogens.

The determination of subclinical manifestation of the rabbit pasteurellosis and eimeriosis is very difficult and the development of methods for their early diagnosis could be subject for future research.

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