INTRODUCTION

Parasitoses belong to the most widespread infectious diseases occurring on farms in Czech Republic. The parasites do not usually cause any deaths and severe clinical diseases but they influence efficiency parameters in all categories of farm animals when lower nutrient conversion resulting in weight loss and growth retardation is mostly their consequence. Other great losses are incurred at slaughterhouses due to the contamination of internal organs (Roepstorff et al., 1998; Nansen and Roepstorff, 1999; Permin et al., 1999; Joachim et al., 2001; Weng et al., 2005). Often the presence of parasites in the animal’s body is the entrance gate for infectious agents of bacterial and viral origin (Ryšavý et al., 1988; Koudela, 2000b).

In technological systems of farms in mild climatic zone animals are often kept permanently in closed barns that become their lifetime space. Animal hygiene in breeding and preventive measures, which can prevent greater economic losses, have a crucial impact on the spread of parasites on farms. An overview of the prevalence and control of animal parasites is a significant prerequisite for efficient animal husbandry especially in closed facilities (Nápravník and Zajiček, 1993).

Resistance of parasites to external environmental conditions

The conditions influencing the prevalence, survival and spread of parasites are determined by abiotic and biotic factors (Anderson and Sukhdeo, 2010). Abiotic factors are of physical and chemical nature; biotic factors are e.g. food supplies, competition and relationships between the host and the parasite (Ibrahim, 2010). A complex of abiotic factors is decisive whether the parasites concerned can or cannot live in the given environment; biotic factors are of crucial importance for determination of the relative frequency of the parasite in question.

Protozoan parasites

Especially coccidia (eimeria, cryptosporidia, isosporas etc.) and giardia (flagellates) belong to the most frequent protozoan parasites in farm animals in conditions of this country. The symptoms of acute coccidiosis differ ac-
cording to the types of coccidia causing this disease and according to the animal species hosting it. A common symptom is diarrhoea accompanied by loss of appetite, general emaciation and a number of patho-physiological changes (Gdovin et al., 1970; Ryšavý et al., 1988). Animals suffer from watery, mucoid or bloody diarrhoea, often very febled and foamy. This state may lead to the overall poor body development after weaning (Dražan et al., 1987; Nápravník and Zajiček, 1993). If the animal survives the infection, it will be resistant to a new infection by the same species.

Coccidia of the genus Eimeria, which occur on farms most frequently, are strictly host specific, it means that one animal species will not be infected by oocysts from the animal of another species; tissue specificity is also high (Gdovin et al., 1970; Ryšavý et al., 1988). Depending on infection severity the animals may die (up to 50% mortality).

Cryptosporidia are parasites that infect epithelial cells of the digestive tract of many vertebrate hosts including humans. Unlike the majority of the other species of coccidia they are characterized by low host specificity and, in addition, they are excreted from the body of the infected animal as sporulated, i.e. infective. Water (drinking, recreational and sea water) and foods contaminated by oocysts from humans and animals have been confirmed as sources of infection.

Cryptosporidiosis is described as a zoonotic disease and the most widespread species is Cryptosporidium parvum (Pavlásek, 1995; Quílez et al., 1996; Fayer et al., 1997; Koudela, 2000a; Dillingham et al., 2002; Guselle et al., 2003; Fayer et al., 2004, Ben-Ami an Regoes et al., 2008, Thieltges and Jensen et al., 2008). An important health problem is that cryptosporidia are resistant to current disinfectants used for treatment of drinking water and they are a frequent and serious complication in individuals suffering from immunodeficiency (O’Donoghue, 1995; Fayer et al., 1997; Dillingham et al., 2002; Thompson and Chalmers, 2002). Cryptosporidia are one of the many parasites for which no medical treatment has been discovered as yet (Thompson and Chalmers, 2002, Finstein, 2004).

The flagellate of the genus Giardia is another protozoan parasite spread all around the world. Giardia is a very successful parasite in its evolution, relationship to the external environment and it has unusual physiological plasticity and adaptation ability to changing internal and external conditions (Fayer, 2004; Gajadhar and Allen, 2004; Craczyk, 2005). Diarrhoea caused by giardiosis can debilitate the afflicted animals for several weeks or months, being manifested by symptoms of alternate intensity. Similar to cryptosporidiosis, giardiasis is an opportune infection, i.e. as a secondary disease it accompanies a primary viral, bacterial or parasitic disease (Chrust et al., 1998; Juránková, 2001).
Cysts of giardia are highly resistant, surviving in water and in soil for several weeks; similar to oocysts of cryptosporidia they are not devitalized by current disinfectants (Gibson et al., 1998; Betancourt and Rose, 2004). If giardiosis has been introduced onto a farm, all animals should be treated. Development of the infection is undoubtedly influenced by nutrition. Protein food suppresses the propagation of giardia while it is stimulated by saccharide food. The intake of mother’s milk substantially contributes to the protection of the young (Chroust et al., 1998; Juránková, 2001).

The survival of cysts in external conditions is similar to that of cryptosporidia. At temperatures around the freezing point they can survive approximately for two months, at –18 °C they die within an hour and temperatures around +70 °C destroy them almost instantaneously. UV radiation is supposed to be highly efficient. Ozonizing and high-quality filters are very efficient in water treatment (Deng and Cliver, 1992; Rimhanen-Finne et al., 2004; Dawson, 2005). The same conditions as in coccidia are applicable in composting (Rimhanen-Finne et al., 2004).

The environment of barns is ideal for oocyst and cyst sporulation, creating very good conditions for the origination and rapid spread of infections. Eradication of these parasites by means of common disinfectants at recommended doses is mostly not efficient. The viability of oocysts and cysts is reduced or totally liquidated only by complete dissication and by the effect of high temperatures. The application of hot water is recommended for sanitation after thorough mechanical cleaning and flushing of rooms with pressure water (Nápravník and Zajiček, 1993; Lukešová et al., 1997).

**Parasitic helminths**

Some species of helminths play a different role in infections, which underlies importance. Concrete losses are incurred by the confiscation of liver, lungs and other organs and their trimmings due to their infestation by parasites (France, 1995; Joachim et al., 1999; Epe, 2002; Resch, 2002; Vergara and Otto, 2002).

Thanks to their resistance, eggs of parasites may be viable for 6 to 10 years under favourable conditions (Straw, 1991; Corwin and Tubbs, 1993; Koudela, 2000b; Lehmann, 2000; Meyer and Schulze-Horsel, 2000b; Rommel et al., 2000; Koudela and Russ, 2002). Helminth eggs are sensitive to direct solar radiation, elevated temperatures and they are dissication-sensitive (Sprehn, 1957; Nápravník and Zajiček, 1993; Roepstorf and Nansen, 1994; Larsen and Roepstorf, 1999; Lehmann, 2000; Rommel et al., 2000). Gaasenbeek and Borgsteede (1998) observed that the eggs in slurry that was at a dry and sunny place survived for 2–4 weeks only a moist and shady place 90% of eggs were whereas capable of further development after eight weeks.

For example eggs of nematode worms of the genus Ascaris (roundworms) belong to the most resistant on ones. Many papers focused on devitalization of these resistant developmental stages. The majority of these papers reported that the survival was prolonged at increasing rH (Jurášek et al., 1993; Nápravník and Zajiček, 1993; Roepstorf and Nansen, 1994; Lukešová et al., 1997; Gaasenbeek and Borgsteede, 1998; Chroust, 1998; Larsen and Roepstorf, 1999; Daugschies, 2000; Hausmann and Hülsmann, 2003).

Temperature is another, not less important factor. Eggs may survive in slurry for more than 3 months at temperatures of 10–17 °C. Putrefactive bacteria and reduced oxygen supply participate in the process of devitalization. Cherepanov et al. (1977, in: Zajiček et al., 1980) tested the efficiency of thermal dehelminthization of liquid manure of pigs and cattle in a facility where it was heated up to 51–56 °C under continuous agitation and they reported the devitalization of all parasitic germs within three hours. Similar results were obtained by Plym-Forsell (1995) when no viable eggs were found in 24 hours in slurry stored in a tank at a temperature of 55 °C. Nápravník and Zajiček (1993) reported that eggs died in 8–10 minutes at 50–55 °C, in 5 minutes at 60 °C and in 1 second at 70 °C. Similar datas were also reported by Zavadil (1960) and Lukešová and Žižlavský et al. (1997).

In general, the larvae survive in humid conditions for a longer time while they can resist to dry conditions only for hours or days, in relation to ambient conditions (Jurášek et al., 1993; Nansen and Roepstorf, 1999). It is to summarize that sunrays, heat, desiccation and oxygen deficit lead to the liquidation of eggs and larvae. Hot solutions of at least 5% lye impair the lipoid layer of the egg envelope and a high temperature above 50 °C destroys the germ in the egg envelope at the same time (Lukešová and Žižlavský et al., 1997; Koudela and Russ, 2002). The parasites are not destroyed by lower temperatures and humidity but their development is prolonged (Larsen and Roepstorf, 1999; Kraglund et al., 2001; Meyer and Schulze-Horsel, 2000a).

**Destruction of parasitic germs in faeces**

It is to note that devitalization efficiency of slurry is applicable mainly during long-time storage (Bornay-Llinares et al., 2006; Heinonen-Tanski et al., 2006). Because fresh slurry is permanently mixed with stored slurry in pits, its devitalization potential is changing. It was found that in deep litter parasitic germs were safely
devitalized in layers deeper than 10 cm but layers within a depth of 10 cm provided an optimum environment for their development.

On most farms pits are built for the collection of liquid manure. On large fattening farms pits are usually unloaded after 2–3 months but from the aspect of sanitation the most suitable are pits allowing the liquid manure storage for 6 months because oocysts of coccidia and eggs of helminths in faeces die within 2–2.5 months at the earliest in the summer season; this time is prolonged at a lower temperature.

It is recommended to perform sanitary measures such as: composting when biological sterilization occurs due to self-heating, aerobic thermophilic sterilization of faeces by means of microorganisms when slurry is exposed to a temperature of 50–60 °C for 5–7 days, application of slurry to fields where their subsequent cultivation is envisaged (ploughing, sowing) and complex microbiological treatment of liquid manure.

The use of some disinfectants or the use of antibiotics negatively influences the course of biological sterilization of slurry. Biological sterilization should be controlled by temperature measurements, establishment of coprocultures or evaluation of the morphological development of germs (sporulation, cleavage) to demonstrate an active course.

**Hygienic measures and prevention of parasitosis**

The aim of hygienic measures is to interrupt developmental cycles of parasites in the environment where farm animals are kept and to prevent infections in animals of all age categories. The elementary condition is to maintain perfect cleanliness in barns by mechanical disposal of faeces, regular pressure washing of pen floors, walls, alleys, platforms and equipment. Simultaneously, mechanical cleaning is followed by thorough disinfection of all the above-mentioned spaces and equipment with water much warmer than 80 °C or steam. If an aqueous solution of disinfectants is used for disinfection, it must be heated to 60 °C at least. These measures are taken whenever the animals vacate the barn or its section and the treated surfaces are let dry thoroughly by ventilation (Chroustová, 1979; Corwin and Tubbs, 1993; Nápravník and Zajiček, 1993; Roepstorff and Nansen, 1994; Chroust, 1998; Meyer and Schulze-Horsel, 2000a; Pollmeier, 2000; Joachim et al., 2001a; Epe, 2002; Lahrmann et al., 2002; Resch, 2002; Vergara and Otto, 2002).

The runs for animals should be kept clean and regular disposal of faeces must be carried out. The animals of different age categories should not be rotated in runs in any case. In litter housing clean straw is distributed every day after the preceding mechanical cleaning of pens. E.g. before late-pregnant sows are moved to a farrowing house or possibly before expected farrowing they are washed with warm water (about 40°C) and before the first sucking of piglets the mammary glands are washed with soap and lukewarm water and all impurities are safely removed. The all-in and all-out system is recommended (Hennessy, 1997; Heinonen-Tanski et al., 2006; Behal, 2006; Smith et al., 2009).

From the aspect of veterinary prevention it is important to monitor the health status of animals, to take faecal samples at regular intervals and to examine them. It is also necessary to perform the consistent veterinary inspection of newly housed and/or bought animals and, last but not least, timely and repeated treatment (Boes et al., 2005) with efficient antiparasitics should be done (Cernanska et al., 2008).

Some experimental studies demonstrated that the application of anthelmintics in the form of injections (Praslicka et al., 1999) was much more efficient than the administration of the product in feed or water. It is to emphasize that not only anthelmintics but also the other antiparasitics should not be used routinely but the treatment should be connected with the other tending measures in relation to the husbandry system in order to reach an optimum effect and to avoid development of resistance, i.e. the application of medications should be performed on the basis of the regular parasitological examination of kept animals (Varady and Čorba et al., 2009). Along with these steps it is necessary to ensure good nutrition, beginning with the newborn. Emphasis is laid on the sufficient intake of colostrum and milk, to supply immunoglobulins in the first weeks of life.

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