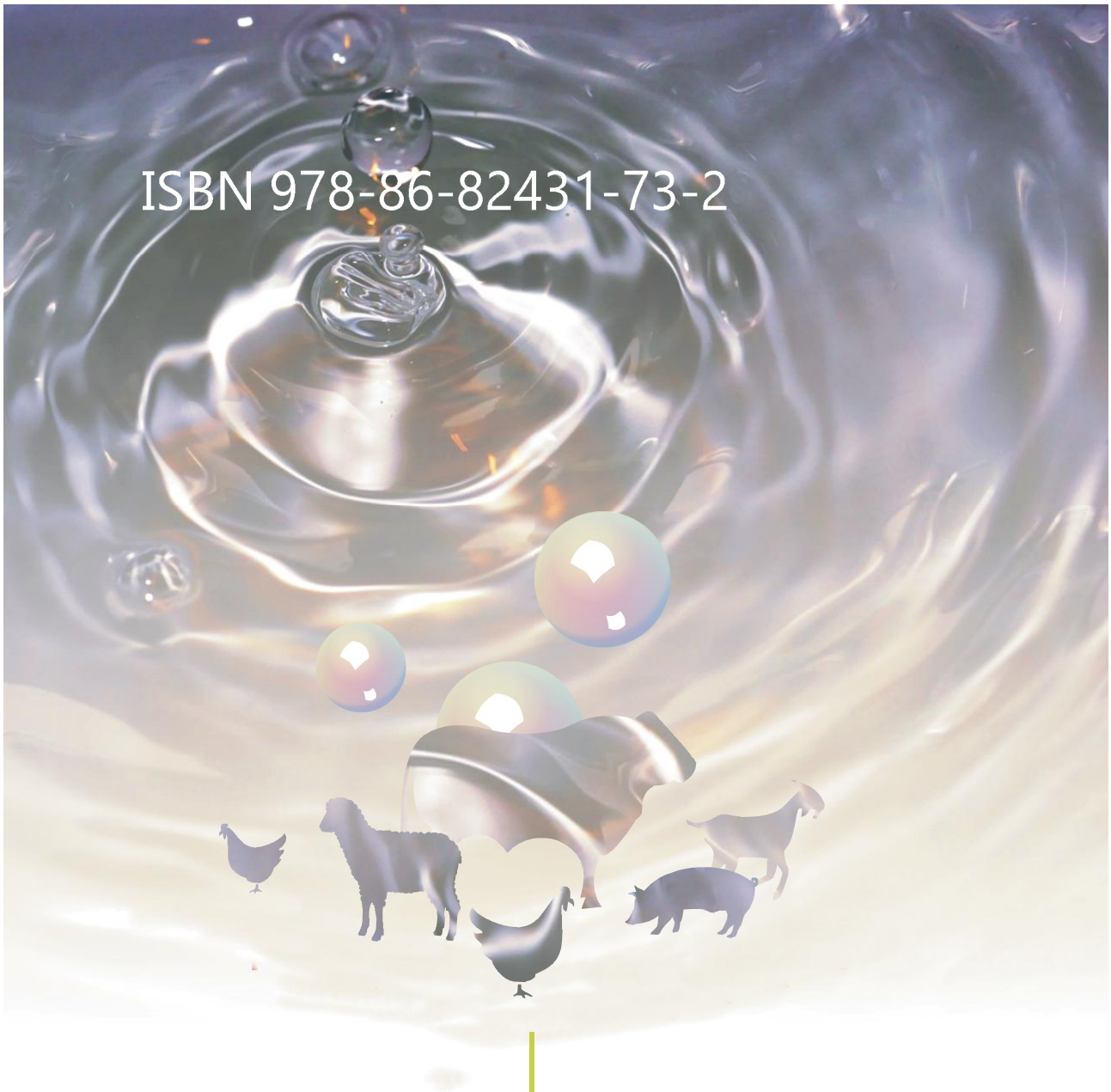
ISBN 978-86-82431-73-2



11th
INTERNATIONAL
SYMPOSIUM

MODERN
TRENDS
IN LIVESTOCK
PRODUCTION

# PROCEEDINGS

11th - 13th October 2017 - Belgrade, Serbia

ISBN 978-86-82431-73-2

INSTITUTE FOR ANIMAL HUSBANDRY
BELGRADE - SERBIA

11th
INTERNATIONAL
SYMPOSIUM

MODERN
TRENDS
IN LIVESTOCK
PRODUCTION

# P R O C E E D I N G S

11th - 13th October 2017 - Belgrade, Serbia

Извор: локална база података COBISS.SR/NBS

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

636/638(082)(0.034.2)
631/635(082)(0.034.2)

INTERNATIONAL Symposium Modern Trends in Livestock Production (11 ; 2017 ;
Belgrade)
   Proceedings [Elektronski izvor] / 11th International Symposium Modern
Trends in Livestock Production, 11 - 13 October 2017, Belgrade ; [editor in
chief Milan M. Petrović]. - Belgrade : Institute for Animal Husbandry, 2017
(Belgrade : Institute for Animal Husbandry). - 1 USB fleš memorija ; 1 x 1
x 3 cm

Sistemski zahtevi: Nisu navedeni. - Nasl. sa naslovnog ekrana. - Tiraž 200.
- Bibliografija uz svaki rad.

ISBN 978-86-82431-73-2

a) Сточарство - Зборници b) Пољопривреда - Зборници
COBISS.SR-ID 245942028

Proceedings of the 11th International Symposium
Modern Trends in Livestock Production
October 11-13, 2017

# PARASITES CONTAMINANT OF GOAT MEAT

**Ivan Pavlović[1], Snežana Ivanović[1], Boris Pisinov[1], Zsolt Becskei[2], Mila Savić[2], Danica Todorović[1]**

[1] Scientific Veterinary Institute of Serbia, V.Toze 14, 11000, Belgrade, Republic Serbia
[2] Faculty of Veterinary Medicine, Bulevar oslobodjenja 18, 11000 Belgrade, Republic Serbia
Corresponding author: dripavlovic58@gmail.com
Review paper

**Abstract.** Goat meat consumed in all parts of the world because of its distinctive taste and desired chemical composition. This meat is rich in protein, vitamins and minerals; it contains very little fat, especially cholesterol and is healthier alternative compared to other types of red meat. The quality of the meat of goats is influenced by breed, gender, productivity and adaptability to stress, environment, management, nutrition, body weight at slaughter and health status as well as the slaughter and procedures with the body after slaughter. In addition, quality also affected by parasitic, bacterial and viral etiology contaminants, which may condition that the meat of these animals is unusable for human consumption and therefore should take care of them. In muscle and edible internal organs of small ruminants, we found adult and developmental forms of the parasite. In the muscles and organs of the most common encountered cyst of zoonotic protozoa *Toxoplasma gondii.* In the liver, we found *Fasciola hepatica* and *Dicrocelium dendriticum*. In the brain occurred *Coenuris cerebralis* (cyst form of *Multiceps multiceps*) Hydatid cysts (cyst stage of *Echinococcus granulosus*) we encountered by the liver, lungs, kidneys, muscles and other internal organs. Cysticercosis caused by *Taenia ovis* and *T.hydatigena* luck of the liver, omentum and muscle.

Their presence leads to a change in the organoleptic characteristics of the food and hygiene failure causing elimination of food from the market and therefore leads to major economic losses.

**Key words:** goats, meat, parasites, contamination, zoonoses

## Introduction

Goats play an important role in many part of Serbia in providing animal protein for diet, especially for those people who live in village at mountains part of

this area. Goats are milked and they produce the bulk milk supply, together with a large proportion of the meat that is consumed (*Ivanović and Pavlović, 2015*).

The quality of the meat of goats is influenced by breed, gender, productivity and adaptability to stress, environment, management, nutrition, body weight at slaughter and health status as well as the slaughter and procedures with the body after slaughter. In addition, quality also affected by parasitic, bacterial and viral etiology contaminants, which may condition that the meat of these animals is unusable for human consumption and therefore should take care of them.

Way of breeding of goats had prerequisite to many infections including parasitoses. They are usually kept under extensive conditions and graze or brows on any land that is not being cultivated (*Vlassoff et al., 2001*, *Ash and Truong, 2003, Pavlović et al.,2012a,b*). After harvesting, the animals are turned onto wheat and barley stubble from which they obtained nourishment. At last decade urban and peri-urban livestock, some households in cities around the world have hailed keeping as a source of livelihood. With the limited grazing spaces, urban farmers have opted for animals that require less space such as small ruminants and pigs. Further, that kind of the breeding of small ruminants (goats and sheep) increased during last decade worldwide. Pasture breeding make possible contact goat within eggs, larvae stages and intermediate host of parasites or ectoparasites like mange or ticks (*Truong and Baker, 1998; Truong et al., 2000; Pavlović et al., 2003a, b; 2012c*)

Those induce that there are no one goats without parasites. Their presence leads to a change in the organoleptic characteristics of the food and hygiene failure causing elimination of food from the market and therefore leads to major economic losses (*Jovanović et al., 2012*).

In our paper, we present the most important parasite species whose presence affects the quality of meat goats and leads to rejection of infected organs on the slaughter line, which affects the profitability of goat production. Besides, some parasitic disease gives rise to human diseases.

## TOXOPLASMOSIS

Toxoplasmosis is parasitic zoonosis caused by protozoa *Toxoplasma gondii*. Primarily hosts was animals from familly Felidae and like intermediate hosts perzistant at 280 species of mammals, birds and reptile (*Acha and Szyfres,1989*). During human infection *T.gondii* was clasified with citomegolviruses and rubeola virus like most dengerous and most usually infection of pregnat women (*Pavlović and Ivanović,2005,2006a*).

Infection with *T.gondi* occured by ingestion of infected tisues or oocists of *T.gondii* (fecal contamination) and by congenital way. At intermediate hosts we

have not enteral cystiforms part of development. Route of infection and free of sporozoites which intracelural replicated in enteral epithelium and belonging limphonoduls where formed tachizoites which via blood transported to tisues (brain,muscles,liver) where formet cysts which contants thousends of cystizoites and bradizoites. Those tisues was infective to definitive and intermediate hosts (*Kapperud et al.,1996*)

*T.gondii* was recognized as a singnificant cause of abortion of small ruminats. Abortion, stillbirths and neonatal mortality occur when susceptible goats are infected during pregnacy. Infection in early gestation leads to death and reasorption of the fetus and can be mistake to fertility (*Dubey,1990; Oréfice and Bonfiol, 2000*). Infection in midle gestation more likely to cause abortion and birth of weak kids, while infection in late gestation results in the birth of live, infected and imune kids (*Pavlović and Ivanović,2005*).At necropsy, macro pathological changes were most significiance at placenta – focal inflamation and necrosis of fetal cotyledon. In fetus we found changes in brain – focal chronically inflamation, unpurulent encephalitis and central calcification. At liver we found focal granulomatosis, at lung necrosis and intestinal miocarditis (*Dubey and Kirkbride, 1990; Tenter an et al., 2000*).

Today we have several methods to diagnosis T.gondii. Serological detection of antibodies in goats sera. High level of IgG occured immediatela afther infection and they persis several months. Necropsy and patholgical changes present reliable signs of toxoplasmosis and use in all suspected cases of infection. Finally, goats meat was examined by digestive methods to presence of cyst of toxoplasma (*Butko and Kostenko, 1983; Pavlović and Ivanović, 2006a).*

Helminths are the largest group of parasites of goats. Although infections with planthelminths are less frequent, related to gastrointestinal helminths, they can also cause serious health problems. This group presented fluke - fasciolosis, distomatosis and paramphistomiasis and larval forms of canidas tapeworm who generating cysts the internal organs of goats.

## FASCIOLOSIS

*Fasciola hepatica* (liver fluke) is leaf-shaped trematoda measured 30 × 2–12 mm. The common liver fluke occurs worldwide but is particularly abundant in humid regions with temperate climate where it can be endemic (*Boray, 2007*). Adult flukes produce eggs in the biliary ducts of their hosts. Eggs are passed in the feces, and miracidia develop within in as little as 9–10 days. Hatching only occurs in water, and miracidia are short-lived and must infected lymnaeid snails at next 2-3 hour. In snail, started asexual development and multiplication occur through the stages of sporocysts, rediae, daughter rediae, and cercariae. Cercariae emerge from

snails, encyst on aquatic vegetation, and become metacercariae (*Maingi et al., 1997*).

Metacercariae may remain viable for many months unless they become desiccated. The incidence of fasciolosis is highest in years when rainfall is above average during May–July (*Hurtrez-Bousses et al., 2001*). The epidemiology of liver fluke is often viewed as the result of two distinct cycles of snail infection and pasture contamination (*Mayberry and Casey, 2001*). After ingestion by the host, usually with herbage, young flukes excyst in the duodenum, penetrate the intestinal wall, and enter the peritoneal cavity, migrating through the liver tissues and crossing the wall of the bile ducts cause the major harm (*Pavlović et al., 2011a*) This process destroys the tissues and causes bleeding. Once in the biliary ducts they complete their development to adult flukes and start producing eggs.

Liver fluke disease in goats occurs in three main clinical forms – acute, subacute and chronic fasciolosis. Which form occurs depends on the numbers of infective metaceriae ingested and the period of time over which they are ingested. There are no typical and easily recognizable symptoms of a liver fluke infection. The major symptoms are related with the inflammation of the liver **(**hepatitis**)** and of the bile ducts **(**cholangitis**)** that can be also due to other disorders (*Hurtrez-Bousses et al., 2001; Mayberry and Casey, 2001*).

Acute fasciolosis caused by the sudden migration of many immature flukes through the liver, which leads to complete organ failure. It can develop in healthy animals that may be killed in a few days. Chronic fasciolosis is develops along the gradual establishment of adult flukes in the bile ducts. It is characterized by the progressive development of such symptoms as anemia edema often as "bottle jaw", digestive disturbances and cachexia**.** Goats do not appear to develop resistance to infection, and chronic liver damage is cumulative over several years (*Kagira and Kanyari, 2001, Pavlović et al., 2011a*).

## DICROCELIOSIS

*Dicrocoelium dendriticum*, the lancet liver fluke, is slender 6–10 mm long × 1.5–2.5 mm wide parasites. They have an indirect life cycle with two intermediate hosts, **a** snail **(***Theba* spp, *Zebrina* spp, or *Cionella* spp**)** and an ant. The eggs shed by adult flukes reach the host's gut with the bile and are expelled with the feces (*Kagira and Kayari, 2001; Manga-Gonzàlez et al., 2003*). Once outside the host terrestrial snails ingest the eggs. Inside the snails young miracidia hatch out of the eggs, develop to sporocysts**,** which on their turn multiply asexually, producing daughter sporocysts which can produce up to cercariae that it remains inside the snail. The snail encysts these cercariae and expels them in the form of sticky slime balls that adhere to the vegetation. Ant (species *Formica* spp

or *Lasius* spp) second intermediate host**,** ingested slimeballs of cercariae (*Alunda and Rojo-Vàzquez, 1983; Sotiraki et al. 2007; Pavlović et al., 2012d*). Inside the ants, most cercariae continue their development to metacercariae in the abdominal cavity. One or two metacercariae in the subesophageal ganglion of the ant cause abnormal behavior in which the ants climb up and remain on the tips of the herbage where they attach themselves, which increases the probability of ingestion by the definitive host.

Once ingested, the metacercariae excyst in the small intestine, migrate up the main bile duct, and then on to smaller ducts (*Mayberry and Casey, 2001; Palić, 2001*). Severe pathologic changes occur within the liver and bile ducts, including cirrhosis, abscesses, and granulomas. Clinical signs are not obvious but may be seen in massive infections (*Pavlović et al., 2012d; Ivanović and Pavlović, 2015*). *D.dendriticum* is part of a group of flukes that can infect the bile ducts of humans.

## COENUROSIS

Coenurosis is a disease of the brain and spinal cord caused by the intermediate stage of *Taenia multiceps.* Adults tapeworms occur in the small intestine of dogs and wild carnivores, and can reach lengths of up to 1 metre. (*Pavlović, 1994, Pavlović et al., 2008; Cirović et al., 2015a,b*).

When the proglottides burst, the eggs are disseminated in the environment contaminating pastures and water supplies. The intermediate host (sheep) ingests eggs expelled with dog faeces. The *larvae* hatch in the intestine and pass with the blood stream towards different organs. The larvae, which reach the brain and spinal cord, grow to the *coenurid* stage. Coenurus cerebralis will further mature in the brain and spinal cord (*Welchman and Bekr-Ochir, 2006; Oryan et al., 2014*). Only those parasites, which reach the nervous system, will develop into a fully developed Coenurus in 7 to 8 months. The definitive host (dog) gets infected by eating infected sheep tissue.

At acute infection in lambs may occur meningoencephalitis because of migration of large numbers of immature stages of this parasite. The chronic stages develop because of increased destruction of brain and spinal cord tissue as the Coenurus grows. The neurological clinical signs are recognised as "gid" or "staggers" and are dependent on the location of the cyst in the central nervous system (*Giadinis et al., 2005; Nourani and Kheirabadi, 2009; Polizopoulou et al., 2016*). Sheep at the chronic stage of the infection may show circular movements, jerky movements or staggering gait (*Pavlović et al., 2017*).

## HYDATIDOSIS

Hydatid disease is an infection caused by tapeworms of the genus *Echinococcus*, a tiny tapeworm just a few millimeters long. They reproduce releasing eggs into the environment in the faeces of the host animal (*Constantine et al., 1993*). Like all tapeworms, the life cycle involves two animals. A carnivore is the definitive host – where the adult worms live in the intestines – and almost any mammal, including humans, can be the intermediate host - where the worms form cysts in various organs (*Pavlović and Ivanović, 2006b; Pavlović et al., 2011b).*

The intermediate host ingests the eggs incidentally while grazing, foraging or drinking. The eggs hatch in the small intestine, become larvae, which penetrate the gut wall, and are carried in the circulatory system to various organs. There the cysts, called hydatid cysts or metacestodes, are formed (*Thompson and Lymbery, 1995*). The disease symptoms are caused by the cysts, which are slow growing fluid-filled structures that contain the larvae and are most often located in the liver or lungs. Called hydatid cysts, for *E. granulosus*, they act like tumours that can disrupt the function of the organ where they are found, cause poor growth, reduced production of milk and meat, and rejection of organs at meat inspection (*Jiménez et al.,2002; Roming, 2005*).

However, the cysts grow slowly so that many infected animals are slaughtered before the cysts ever cause disease problems. There may however be multiple cysts of *E. granulosus* which can also occur in the brain, kidneys, bones,or testes causing more severe illness. Without control measures, infection rates can be very high in livestock and dogs, with associated signifi cant incidence in humans (*Pavlović and Ivanović, 2006b; Brunetti and Filice, 2008*).

## CISTICERCOSIS

Cysticercosis is a disease caused by the larval forms of tapeworm species of which commonly encountered by *Taenia hydatigena* and *T.ovis*.

### *Taenia hydatigena*

This tapeworm lives in the small intestine of dogs, foxes and other carnivores and was long 1.5-5 m (*Pavlovic, 1994; Pavlovic et al., 2008).* In mature targument are eggs that excreted into the environment. Infection occurs with parasite eggs. In the gastro-intestinal tract of intermediate host oncospheres eggs, penetrate the intestinal wall and get into the peritoneal cavity (*Pathak et al., 1982*). Then occur bleeding on the surface of the liver and then in the parenchyma. In these channels leads to the destruction of the liver parenchyma, the accumulation

of fibrin and red blood cells and the developing worm-like larvae that for a couple of weeks coming to the surface of the liver. Hence the switch to omentum and mesentery, where end development. In addition to liver and mesentery, larvae encountered other organs, most in lungs (*Manfredi et al., 2006*). There the larvae are fixed and form cysts known as *Cysticercus tenuicollis*. These cysts are long neck, retracted in a vesicle diameter of about 3 cm (and larger). Harmful operation ovh cyst is the most common mechanical nature - caused by damage to blood vessels during migration through the liver and the resulting inflammation that can spread to the peritoneum and cause peritonitis. In the abdominal cavity found bloody content. In acute inflammation, the liver are present fibrin deposits and at the intersection to see the ducts (*Blazek et al., 1985*). The lungs are lucky emphysema and bleeding in the lung parenchyma. The thoracic cavity is serofibrinozna fluid and pleural edema. The disease is usually chronic course.

***Taenia ovis***

T. ovis lives in the small intestine of dogs, foxes and other carnivores and the debt is up to 5m (*Soulsby, 1977*). After infection, the eggs of parasites in the intestines of small ruminants are released embryos that penetrate the intestinal wall and the bloodstream to muscle tissue where they develop cystic formations (*Gregory 1976*). Most often infected myocardium, diaphragm, skeletal muscles and chewing. (*Coman and Rickard, 1975; DeWolf et al., 2013*). The cysts are developing larvae for 46 days become infectious for real hosts. Pregnant animal is possible intrauterine infection of the fetus.

Over time, the cysts of the muscles degenerate, and then calcifying caseous nodules formed structure. This is the stage of the disease is in small ruminants also known as "chicken pox" because it looks like pure muscle that is similar to pustular changes with smallpox (although nothing to do with real uzročnicma goddess - pox virus) (*Ericson, 2011*). T. ovis not pathogenic for small ruminants and does not constitute a risk to human health, but these calcified cysts have unpleasant looks as mentioned above and lead to the rejection of large quantities of sheep meat especially in Britain, Australia and New Zealand where disease are most present.

## Conclusion

Parasitic infections produced great losses to goat production. In addition to direct damaging through the operation of reduced growth, milk yield, and the concept of these diseases affect the quality of meat of the skin as well as the rejection of the infected organs from slaughter line.

However, some forms of food borne parasite development (*Toxoplasma gondii*) are retained in the animal tissue and cause infection in humans who eat inadequately cooked meat and organs of infected animals.

Their presence leads to a change in the organoleptic characteristics of the food and hygiene failure causing elimination of food from the market and therefore leads to major economic losses.

## Parazitska kontaminiranost mesa koza

*Ivan Pavlović, Snežana Ivanović, Boris Pisinov, Zsolt Becskei, Mila Savić, Danica Todorović*

## Rezime

Meso koza se konzumira u svim delovima sveta zbog svog jedinstvenog ukusa i poželjnog hemijskog sastava. Ovo meso je bogato proteinima, vitaminima i mineralima, sadrži veoma malo masti pogotovuholesterola i mnogo ej zdravijeg sastava od većine drugih vrsta mesa. Kvalitet mesa zavisi od načina držanja, pola životinja, produktivnog i adaptibilnog stresa, životnih uslova i načina držanja, ishrane, težine i zdravstvenog stanja. Na kvalitet mesa utiče i način klanaj i postupak sa mesom po klanju. Na kvalitet uiče i prisustvo parazitskih, bakterijskih i virusnih kontaminenata koje mogu učiniti meso koza neupotrebljivim za ljudsku ishranu.

U mišićima i jestivim organima malih preživara može se naći ciste zoonotske protozoe *Toxoplasma gondii*. U jetri, mogu se naći odrasli i razvojni oblici *Fasciola hepatica* i *Dicrocelium dendriticum*. U mozgu se mogu naći ciste *Coenuris cerebralis* (cistični oblik *Multiceps multiceps*). Hidatidne (ehinokokne) ciste se sreću po jetri, plućima, bubrezima, u mišićima i po drugim organima. Konačno tu su i cistični oblici *Taenia ovis T.hydatigena* koje nalazimo na omentumu i jetri.

Nalaz ovih parazita menja organoleptička svojstva mesa i organa čineći ih neupotrebljim za ishranu i preradu što dovodi do značajnih ekonomskih gubitaka.

**Ključne reči:** koze, meso, paraziti, kontaminacija, zoonoze

## Acknowledgment

Research was financed by the Ministry of Science and Technological Development, Republic of Serbia, project TR 31053 and TR 31085

## References

ACHA P., SZYFRES B. (1989): Zoonoses et malades transmissible communes a l homme et animaux, OIE, Paris. pp39.

ALUNDA J., ROJO-VÀZQUEZ F. (1983): Survival and infectivity of Dicrocoelium dendriticum eggs under field conditions in NW Spain. Veterinary Parasitology 13, 245-249.

ASH R., TRUONG P. (2003): The use of vetiver grass wetland for sewerage treatment in Australia. Proceeding of the International Conference on Vetiver and Exhibition, October 6-9, Guangzhou, 20.

BENNER C., CARABIN H, SÁNCHEZ-SERRANO L.P, BUDKE C.M., CARMENA D. (2010): Analysis of the economic impact of cystic echinococcosis in Spain. Bulletin of the World Health Organization 88, 49-57.

BLAZEK K, SCHRAMLOVA J, HULINSKA D. (1985): Pathology of the migration phase of *Taenia hydatigena* (Palas 1766) larvae. Folia Parasitologica 32, 127–137.

BORAY J.C. (2007): Liver fluke disease in sheep and cattle. Primefact 446.

BUDKE CM, DEPLAZES P, TORGERSON PR. (2006): Global socioeconomic impact of cystic echinococcosis. Emerging Infectiouse Disease 12, 296-303.

BUTKO, M.P.,KOSTENKO J.B (1983): Rukovodstvo po veterinarskoj ekspertizi mjesnih produkov. Legkaja pišćeva promišlenost, Moskva, pp.56.

COMAN B.J., RICKARD M.D. (1975): The location of Taenia pisiformis, Taenia ovis and Taenia hydatigena in the gut of the dog and its effect on net environmental contamination with ova. Zanderblat fur Parasitekund 47, 237-248.

CONSTANTINE C.C., THOMPSON R.C.A., JENKINS D.J., HOBBS R.P., LYMBERY A.J. (1993): Morphological characterisation of adult Echinococcus granulosus as means of determinating transsmition paterns. Journal of Parasitology 79, 57-61.

CIROVIC D.S., PAVLOVIC I.N., PENEZIC A.Z., KULISIC Z,B., SELAKOVIC S. (2015a): Levels of infection of intestinal helminths species in the golden jackal Canis aureus from Serbia. Journal of Helminthology 89 (1), 28-33.

ĆIROVIC, D., PAVLOVIĆ, I., PENEZIĆ A. (2015b): Intestinal helminth parasites of the grey wolf ( Canis lupus L.) in Serbia. Acta Veterinaria Hungarica 63(2),189-198.

DeWOLF D.B., POLJAK Z., ANDREW S. PEREGRINE S.A., JONES-BITTON A., JANSEN T.J., MENZIESP.I. (2013): Development of a Taenia ovis transmission model and an assessment of control strategies. Veterinary Parasitol 198 (1-2), 127-135.

DUBEY, J.P., KIRKBRIDE C.A. (1990): Toxoplasmosis and other causes of abortion in sheep from North central United States. Journal of American Veterinary Medicine Association 196, 287 -290.
ERICKSON A. (2011): Taenia ovis (Sheep measles) infection in sheep Department of Agriculture and Food, Kesington,Western Australia, pp1-2.
GIADINIS N.D., PANOUSIS N.K., POLIZOPOULOU Z.S., KARATZIAS H. (2005): Neurological examination of small ruminants. Jpurnal of Hellen Veterinary Medicine Society 57, 11-18.
GREGORY G.G. (1976): Fecundity and proglottid release of Taenia ovis and T. Hydatigena.Australian Veterinary Journal 52 (6), 277-279.
HURTREZ-BOUSSES S., MEIJNIER C., DURAND P., RENAUD F. (2001): Dynamics of host-parasite interactions: the example of population biology of the liver fluke (Fasciola hepatica). Microbes and Infections 3, 841-849.
IVANOVIĆ S., PAVLOVIĆ I. (2015): Meso koza-bezbedna namirnica. Naučni institut za veterinarstvo Srbije,Beograd, pp.75-131, 186-194.
JIMÉNEZ S, PÉREZ A, GIL H, SCHANTZ P, RAMALLE E, JUSTE R. (2002): Progress in control of cystic echinococcosis in La Rioja, Spain: decline in infection prevalences in human and animal hosts and economic costs and benefits. Acta Tropica 83, 213-221.
JOVANOVIĆ L., PEŠIĆ-MIKULEC D., PAVLOVIĆ I, (2012): Granski standardi kvaliteta i bezbednosti u prehrambenoj industriji i primarnoj proizvodnji : upravljanje rizicima u proizvodnji i distribuciji hrane. Naučno-stručno društvo za zaštitu životne sredine Srbije "Ecologica", Beograd, pp.137.
KAGIRA J.M., KANYARI P.W.N. (2001): The role of parasitic diseases in causing mortalities in small ruminants in a highly productive area of Central Province, Kenya. Journal of South Africa Veterinary Association 72, 147-149.
KAPPERUD G, JENUM P.A.,STRAY-PEDERSEN B.,MELBY K.K.,ESKILD A., ENG J. (1996): Risk factors for Toxoplasma gondii infection in pregnancy. Results of a prospective case-control study in Norway. American Journal of Epidemiology 144, 405–412.
MAINGI N., GICHOHI V.M., MUNYUA W.K., GATHUMA J.M., THUMSBORG S.M. (1997): The epidemiology of nematode and liver fluke infections in sheep in Nyandarua district of Kenya. Bulletin of Animal Health and Production 45: 27-34.
MAYBERRY C., CASEY R. (2001): Stockguardsheep and goats strategic assessment –liverfluke. Department of Agriculture and Food, Kesington,Western Australia, pp1-13.
MANGA-GONZALEZ, M., GONZÀLEZ-LANZA C., CABANAS E., CAMPO R. (2003): Contributions to and review of dicrocoeliosis, with special reference to the intermediate hosts of Dicrocoelium dendriticum. Parasitology 123, 91-114.

MAS-COMA S. (2005): Epidemiology of fascioliasis in human endemic areas. Journal of Helminthology 79, 207-216.
MANFREDINI M.T., GHIRARDELLI R., ZANZANI S.(2006): Cysticercus tenuicollis infection in a goat farm. Parassitologia 48(3), 433-436.
NOURANI H., KHEIRABADI K.P. (2009): Cerebral coenurosis in a goat: pathological findings and literature review. Compared and Clinical Pathology 18, 85–87;
ORÉFICE F., BONFIOL A.A. (2000): Toxoplasmose In: Oréfice F, editor. Uveíte clínica e cirúrgica- Rio de Janeiro: Editora Cultura Médica; pp 619–680.
ORYAN A., AKBARI M., MOAZENI M., AMRABADI O.R. (2014): Cerebral and non-cerebral coenurosis in small ruminants. Tropical Biomedicine 31(1),1-16.
PALIC D. (2001): Bolesti koza, Grafos internacional,Pančevo, pp.122.
PATHAK K.M.L., GAUR S.N.S., SHARMA S.N. (1982): The pathology of Cysticercus tenuicollis infection in goats. Veterinary Parasitology 11(2-3),131-139.
PAVLOVIĆ, I. (1994): Helmintofauna lisica (Vulpes vulpes L.) ulovljenih na području Beograda u periodu 1988-1992.godine. Doktorska disertacija. Univerzitet u Beogradu Fakultet veterinarske medicine.
PAVLOVIĆ I., IVANOVIĆ S. (2005): Toxoplasmosis of goats and its role and importance of goat production. Biotechnology in Animal Husbandry 21 (5-6), 123-126.
PAVLOVIĆ I., IVANOVIĆ S. (2006a): Toksoplazmoza.Naučni institut za veterinarstvo Srbije i Ministarstvo poljoprivrede, šumarstva i vodoprivrede, Beograd, pp33.
PAVLOVIĆ I., IVANOVIĆ S. (2006b): Ehinokokoza/hidatidoza,bolest životinja i ljudi, izd. Naučni institut za veterinarstvo Srbije i Ministarstvo poljoprivrede, šumarstva i vodoprivrede, Beograd, pp33.
PAVLOVIĆ I., TAMBUR Z.,DODER R., KULIŠIĆ Z.,JAKIĆ-DIMIĆ, D. (2008) The cestodes of the foxes (Vulpes vulpes L.) catched in Serbia in the paeriod 1994-2006. Veterinaria 57 (1-2), 100-108.
PAVLOVIĆ I., IVANOVIC S., ŽUJOVIĆ M.,TOMIĆ Z., MEMIŠI N. (2011a): Fascioloza koza u Srbiji. Zbornik naučnih radova Instituta PKB Agroekonomik 17 (3-4),163-169.
PAVLOVIĆ, I., HADŽIĆ I., ŽUGIĆ G., ANĐELIĆ-BUZANIĆ G.,VAIĆ D., JOVČEVSKI SR. (2011b): Hidatidoza aktuelni problem stočarske proizvodnje. Zbornik naučnih radova Instituta PKB Agroekonomik 17 (3-4), 133-139.
PAVLOVIĆ I., IVANOVIĆ S., ŽUGIĆ G., JOVČIĆ D., BOJKOVSKI J, PAJIĆ M. (2012a): Season distribution of gastrointestinal. helminths of small ruminants in spread Belgrade area Lucrări Ştiinţifice Medicină Veterinară Timişoara XLV(3), 155-160.

PAVLOVIĆ I., IVANOVIĆ S., JOVIČIĆ D., ŽUGIĆ G., JOVČEVSKI SR., JOVCEVSKI ST. (2012b): Gastointestinal helmints of goats breeding at Stara Plana area(Serbia). Book of Abstracts V International Symposium of Livestock Production, September 5-7, Skopje, Macedonia,144.

PAVLOVIĆ I., IVANOVIĆ S., ŽUJOVIĆ M., TOMIĆ Z. (2012c): Influence of gastrointestinal helminths to goat health and production. Proceedings of 6th Central European Congress on Food, May 23-26, Novi Sad, Serbia, 1605-1607.

PAVLOVIĆ I., IVANOVIĆ S., SAVIĆ B., BOJKOVSKI J., HADŽIĆ I., ANĐELIĆ-BUZADŽIĆ G., JOVČEVSKI SR., ŽUGIĆ G., JOVČEVSKI ST.(2012d): Značaj dikrocelioze u zdravstvenoj problematici koza i ovaca**.** Zbornik naučnih radova Instituta PKB Agroekonomik 18 (3-4), 163-169.

PAVLOVIĆ I. IVANOVIĆ S. BOJKOVSK J. JOVČEVSKI SR. JOVČEVSKI ST. ROGOŽARSKI D. DOBROSAVLJEVIĆ I. HADŽIĆ I. MINIĆ S. (2017): Cenuroza malih preživara. Zbornik naučnih radova Institut PKB Agroekonimk 23 (3-4), 51-57.

POLIZOPOULOU S.Z., GIADINIS. D.N., PAPAHRISTOU. A..PAPAIOANNOU. N. (2016)**:** Neurological diseases of small ruminants in Greece: a retrospective study in 114 flocks. Acta Veterinaria-Beograd, 66 (2), 160-171.

SOTIRAKI S., LEONTIDES L., HIMONAS C. (2007): The effect of transportation and confinement stress on egg production by Dicrocoelium dendriticum in sheep. Journal of Helminthology 73, 337-339.

SOULSBY E.J.L. (1977): Helminth, Arthropod and Protozoa of Domesticated Animals. Bailler,Tindall and Cassell, London, pp.237.

TENTER A.M., HECKEROTH A.R.,.WEISS L.M (2000): Toxoplasma gondii: from animals to humans. International Journal of Parasitology 30, 1217–1258.

THOMPSON R.C.A:, LYMBERY A.J (1995): Echinococcus and hidatid disease. CAB International, Biddles Ltd. Guildford, pp75.

TRUONG, P.N., BAKER, D. (1998): Vetiver grass system for environmental protection. Technical Bulletin N0. 1998/1. Pacific Rim Vetiver Network. Royal Development Projects Board, Bangkok, Thailand, 45.

TRUONG P.N., MASON F., WATERS, D., MOODY P. (2000): Application of vetiver Grass Technology in off-site pollution control. I. Trapping agrochemicals and nutrients in agricultural lands. Proceeding of Second International Vetiver Conference, Januar 18-22, Bangkok, Thailand, 20.

VLASSOFF A., LEATHWICK D.M., HEATH A.G.C. (2001): The epidemiology of nematode infections of sheep. New Zeland Veterinary Journal 49, 213-221.

WELCHMAN, D,DE B., BEKR-OCHIR, G. (2006): Spinal coenurosis causing posterior paralysis in a goat in Mongolia. Veterinary Record, 158, 238–239.