Prevalence of *Taenia saginata* larvae infection in cattle from Northwestern Romania (2009-2013)

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**Abstract.** Studies concerning the incidence and dynamic of infection with *T. saginata* larvae are not reported systematically in Romania. Therefore, the magnitude of the phenomenon cannot be adequately evaluated. Taking into account this aspect, an epidemiological study between 2009 and 2013 was done to establish the incidence and prevalence of the infection with *T. saginata* larvae in Northwestern Romania. The study included eight counties: Alba, Bihor, Bistrita-Nasaud, Cluj, Maramures, Mures, Salaj and Satu-Mare. The analysis was conducted on confirmed infections, following carcasses inspection in slaughterhouses, in accordance with The National Strategic Program of Epidemiological Surveillance for bovine cysticercosis. The results showed that 12 out of 107,843 slaughtered and post-mortem examined cattle (0.011%) were infected with *Cysticercus bovis*. Eleven carcasses originated in Bistrita-Nasaud county and one in Alba. In terms of temporal spread, cases of bovines diagnosed with cysticercosis were reported only in 2009. The collection, synthesis and analysis of these data can contribute to the quantifying of the current situation of muscle cysticercosis in cattle in the northwest of Romania. Its purpose is to apply effective measures for reduction, even eradication of infections and to prevent transmission of infection to humans.

**Keywords:** Cattle; Cysticercosis; Meat inspection; Prevalence; Romania.

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**Introduction**

Bovine muscular cysticercosis is a metacestodosis induced by *Cysticercus bovis*, the larval form of *Taenia saginata*. The adult tapeworm infects the human being localized into the small intestine, and its larva develops in the muscle of cattle (Neva and Brown, 1994; Carpio, 2002).

The cattle farming is an important sector of modern agriculture in Romania. The products
offered, respectively an essential food with high biological and nutritional value help the increasing of the living and civilization standards.

Rational development of animal husbandry and food industry is achieved through the application of some veterinary control measures. These measures aim to improve the health of the animals of economic interest, thus guaranteeing the human health.

Among these diseases, cattle cysticercosis causes significant economic losses to farmers, in the meat marketing and processing sector (Dorny and Praet, 2007; Dupuy et al., 2014; Rossi et al., 2015). In slaughterhouses an infected carcass loses its value; the price is 50% reduced, due to the cost of required freezing process to inactivate cysticercus larvae. Major infections cause the total confiscation of carcasses.

Bovine cysticercosis is monitored in UE, according to the EC Regulation no. 854/2004 (EC, 2004) (under review) from the European legislation, which describes the meat inspection process and requirements. Currently, the diagnosis is made based only on a visual inspection of meat; the method has a low sensibility, less than 30% (Dorny et al., 2010).

In spite the obligatory inspections of the carcasses, *T. saginata* still emerges in UE (Dorny and Praet, 2007). The risk factors are known and identified: waste waters spillage, mud from the water treatment plants, flooding of grasslands, water consumption by tourists from unknown sources (Ilsøe et al., 1990; Kyvsgaard et al., 1991; Flütsch et al, 2008). Despite this, the meat inspection and treating the persons working in contaminated farms remain, for now, the unique ways of control (Boone et al., 2007; Dorny et al., 2010).

Regarding the public health, *Taenia saginata* appears to have a little impact because humans cannot develop cysticercosis with *T. saginata*. However, food safety is essential in our society and getting a 10-meter long tapeworm after consumption of infected beef meat, raw or insufficiently prepared, is unacceptable. In that matter, the expenses regarding medical examinations, diagnostic tests and taeniacide products should not be underestimated.

Generally, bovine cysticercosis has a low global prevalence, but in some areas as Africa, some regions from Caucas, Southern and Central Asia and Eastern of Mediterranean Sea registered a high prevalence (OIE, 2008). Both in industrialized and developing countries, there is a lack of knowledge concerning taeniasis and cysticercosis.

In Europe, the prevalence of taeniasis in humans varies between 0.01 and 10%, the highest values being reported in Slovakia and Turkey (Cabaret et al., 2002). On the other hand, the prevalence of muscle cysticercosis in cattle varies between 0.007 and 6.8%, values based on the carcasses inspection reports, as follows: Italy 0.02 to 2.4; Poland 0.24; Spain 0.007 to 0.1; Belgium 0.03-0.2 (Geerts, 1992); Netherlands 1.8-2.2 (Van Knapen and Buys, 1985); Germany 0.4-6.8 (Mobius, 1993; Zimmerman, 1985), and 0.1-0.7 in Denmark (EFSA, 2004; Cabaret et al., 2002). Although there are available data regarding taeniasis and cysticercosis in humans and animals, their accuracy is questionable, mainly because of the imperfect tests for diagnostic (Dorny et al., 2010), leading to underestimation of the true prevalence.

The aim of present work is to determine the prevalence of *Taenia saginata* larvae infection in cattle from Northwestern Romania, between 2009 and 2013, where data on the occurrence and evolution are missing.

**Materials and methods**

Data regarding the number of slaughtered cattle and animals infected with *Cysticercus bovis*, reported by County Veterinary Authority (Sanitary Veterinary and Food Safety Department – SVFSD) between 2009 and 2013, were utilized and processed. Data originating from eight counties: Alba, Bihor, Bistrita-Nasaud, Cluj, Maramures, Mures, Satu Mare and Salaj were recorded.

Diagnosis of *C. bovis* infection is done in slaughterhouses, according to Romanian and
European Veterinary legislation (Ord. no. 29/2014; The European Community Regulation (EC) no. 854/2004). Consistent with this, all cattle older than 6 weeks sacrificed in authorized slaughterhouses are antemortem and postmortem examined by an official veterinarian through visual inspection of carcasses, without cutting the muscle. Cattle younger than 6 weeks does not require examination for *C. bovis* due, on the one hand, feeding with milk and, on the other hand, the larvae become infective for humans at 8-12 weeks post-infection. Infected carcasses are subjected to legislative measures dependent on its magnitude. If an animal shows a generalized infection, the carcass and offal are declared unfit for human consumption. If the infection is localized, the carcass must be stored at a temperature not exceeding -10°C for more than 14 days before consumption.

Based on obtained data, the prevalence of infection was calculated according to the known calculation methodology. It should be mentioned that nationally, bovine cysticercosis is not among the national and international reported diseases, according to Order 79/2008 and Order 77/2005.

**Results**

A total of 107,843 bovines were sacrificed in sanitary authorized slaughterhouses in the mentioned counties during the studied period. The analysis of the data revealed that there is a small number of cattle slaughtered annually which gradually declines by about 10%. Most of the slaughtered cattle (about 74%) originated in three counties (Bistrita-Nasaud, Maramures and Alba) (table 1). In Salaj county, there are not veterinary authorized slaughterhouses. Therefore, counties SVFSD did not report slaughtered cattle. The incidence and prevalence of infection with *Taenia saginata* larvae in cattle are shown in table 2.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of slaughter animals</th>
<th>Positive No.</th>
<th>%</th>
</tr>
</thead>
</table>
| 2009 | 23,663                  | 12           | 0.050%
| 2010 | 28,077                  | 0            | 0  |
| 2011 | 21,014                  | 0            | 0  |
| 2012 | 17,951                  | 0            | 0  |
| 2013 | 17,138                  | 0            | 0  |
| TOTAL| 107,843                 | 12           | 0.011% |

In 2009, there were 12 newly reported cases of *C. bovis* infection in the mentioned counties, revealing an incidence of 0.05%. Particularizing, 1,657 bovines were slaughtered in 2009 in Alba County. One animal presented infection with *C. bovis*, the incidence of muscle cysticercosis being 0.06%. During the same year, 7,159 cattle were slaughtered in Bistrita-Nasaud of which 11 were infected, the incidence of muscular cysticercosis being 0.15%.

The prevalence of the positive cases between 2009 and 2013 was 0.011%, characterizing a low level of infection during the period and areas studied. The spatial distribution of *C. bovis* infection was characterized by the spread of the outbreaks in Alba (one animal) and Bistrita-Nasaud (11 cattle) counties while was absent in other counties.

### Table 1. Evolution of the number of slaughtered animals during the studied period

<table>
<thead>
<tr>
<th>Year</th>
<th>ALBA</th>
<th>BIOR</th>
<th>BISTRITA-NASAUD</th>
<th>CLUJ</th>
<th>MARAMURES</th>
<th>MURES</th>
<th>SATUMARE</th>
<th>SALAJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1,657</td>
<td>515</td>
<td>7,159</td>
<td>750</td>
<td>7,723</td>
<td>2,848</td>
<td>3,011</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>6,524</td>
<td>631</td>
<td>8,350</td>
<td>352</td>
<td>6,888</td>
<td>2,367</td>
<td>2,965</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>6,329</td>
<td>497</td>
<td>5,272</td>
<td>2</td>
<td>3,776</td>
<td>2,005</td>
<td>3,133</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>4,857</td>
<td>377</td>
<td>5,421</td>
<td>6</td>
<td>2,865</td>
<td>1,780</td>
<td>2,645</td>
<td>0</td>
</tr>
<tr>
<td>2013</td>
<td>3,933</td>
<td>363</td>
<td>5,617</td>
<td>611</td>
<td>3,360</td>
<td>1,627</td>
<td>2,077</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>23,300</td>
<td>2,383</td>
<td>31,019</td>
<td>1,271</td>
<td>24,627</td>
<td>10,627</td>
<td>13,831</td>
<td>0</td>
</tr>
</tbody>
</table>

In 2009, there were 12 newly reported cases of *C. bovis* infection in the mentioned counties, revealing an incidence of 0.05%. Particularizing, 1,657 bovines were slaughtered in 2009 in Alba County. One animal presented infection with *C. bovis*, the incidence of muscle cysticercosis being 0.06%. During the same year, 7,159 cattle were slaughtered in Bistrita-Nasaud of which 11 were infected, the incidence of muscular cysticercosis being 0.15%.
Discussions

In Romania, a powerful recession of the economic activities, similar to the other Eastern European countries, has been recorded after changing the political regime and transition to a new system of production. This setback was fully felt also in cattle breeding. This domain was strongly influenced by the new situation and consisted in significantly reducing of bovine herds and consequently in decreasing of the livestock slaughtered between 2009 and 2013 (with an approximate rate of 10% per year).

In this context, National Program of Epidemiological Surveillance of the Diseases stipulates that bovine cysticercosis is diagnosed and confirmed post-mortem by examining the carcass (visual inspection) during the slaughtering of animals. The revealed data have demonstrated a low prevalence of cysticercosis in bovine muscle, 0.011% respectively. Moreover, these data allow us to affirm that *Taenia saginata* larvae infection is present in the north-west of Romania, in limited spatially (Alba, Bistrita-Nasaud) and temporally (2009) outbreaks. At the European level, comparing the value of prevalence revealed in the North-west of Romania (0.01%), it is found that countries like Croatia and Denmark have reported similar values (Zdolec et al., 2012; Ilsøe et al., 1990).

However, the true prevalence is certainly underestimated due to reduced sensitivity of postmortem examination (below 30%). Dorny and Praet (2007) state that the meat inspection is an exam with a low sensitivity, having the risk of not detecting weak infected carcasses. The increasing of slaughterhouse exam sensitivity is however possible by raising the number of incisions in the muscle tissue (Wanzala et al., 2003; Eichenberger et al., 2013).

Predilection site is also involved in the diagnostic sensitivity. Lopes et al. (2011) evaluated these sites in 25 naturally infected cattle and demonstrated that the highest percentage of cysts (75.02%) was highlighted in skeletal muscle (the shoulder blade and spine muscles). These sites are not officially examined in our country.

On the other hand, *Taenia saginata* larvae infections create both, veterinary and medical problems. The problems are more economical from the veterinary point of view because the slaughterhouse diagnosis and subsequent confiscations mean economic losses. In terms of human medicine, the problem is primarily clinical and only secondary, economic. However, there is a direct correlation between humans and cattle, ensuring the parasite biology in nature. People suffering from taeniasis (bearing intestinal tapeworms) are responsible for the spread of infection in cattle. The consumption of infected beef can cause taeniasis. Nevertheless, current programs for prevention and control of bovine cysticercosis are mainly based on the slaughterhouse diagnosis. Taeniasis is not a notifiable disease and, therefore, cases are not reported to the National Authorities, the control of infection being based solely on individual anthelmintic treatments.

To reduce the negative economic impact in both sectors – health and the processing and marketing of meat – policymakers should consider to include taeniasis among officially reportable diseases. As a result, the accuracy of the epidemiological data will be improved and a Program of surveillance and control of this zoonosis can be developed.

The proper control and prevention methods that should be applied are proper management of wastewater and detection of bovine cysticercosis, for example, by using serological methods (in addition to meat inspection) (Murrell et al., 2005).

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References


*** Order no. 29/2014 approving the methodological norms for the implementation of the Surveillance, prevention, control and eradication programme of animal diseases transmissible from animals to humans, animal protection and environmental protection, the identification and registration of bovine animals, swine, sheep and goats for 2012, and

