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Infectious and parasitic diseases in European hares (*Lepus europaeus* Pall.) from the Lublin Upland detected by macroscopic autopsy

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Summary

The European hare (*Lepus europaeus*), commonly known as the gray hare, belongs to the Leporidae family. Widely distributed throughout Poland, it exhibits higher population density in the eastern regions. However, Europe has witnessed a significant decline in hare populations over the past 50 years, a trend also observed in most Polish areas. Contributing factors include intensified agriculture, habitat loss, urbanization, pollution (water, air, and soil), and climate change, all impacting population dynamics, including reproduction. Increased predation by foxes, raccoons, and birds of prey, along with poaching and hunting-related damage, further affect hare populations. Infectious and parasitic diseases play a crucial role in hare health, often leading to mortality. These animals constantly interact with various pathogens and vectors due to their natural environment. The objective of this study was to assess the health of the European hare population in the Lublin Upland based on macroscopic findings during autopsies. The research involved 85 hares from two hunting districts in the western part of the Lublin Upland. These animals were necropsied, and material was collected for laboratory tests. Macroscopic examinations revealed the presence of several diseases, including brucellosis (6 cases), rodentiosis (11 cases), tularemia (3 cases), echinococcosis (5 cases), and cysticercosis (11 cases). Most of these diseases are classified as dangerous zoonotic infections. The detection of multiple diseases underscores the gray hare's role as a reservoir in the natural environment. These confirmed diseases pose significant risks, often proving fatal for both hares and their predators. As a game species, European hares also pose a threat to hunters who handle infected animals. Moreover, meat from sick hares jeopardizes consumer health and safety. This research holds substantial importance for veterinary medicine and public health, aiding in early diagnosis and effective disease prevention strategies.

Keywords: gray hare, infectious diseases, parasites, zoonoses, free-living animals

The European brown hare (*Lepus europaeus*) is a popular game species in Poland, whose population has experienced a significant decline in recent years. Historically, during the 20th century, the hare population was estimated at approximately 3 million individuals. However, over the past five decades, this number has decreased by a factor of five, accompanied by a reduction in hunting activity targeting this species. The decline in hare numbers began in the 1970s and can be attributed to multiple factors (6, 27). Notably, the highest population density of gray hares in 2023 was observed in the Masovian Voivodeship (167.3 thousand), Łódź Voivodeship (108.9 thousand), and Lublin Voivodeship (114.9 thousand). Despite the overall decline, recent statistical data from the Central Statistical Office indicate an increasing trend in recorded hare individuals (38). Several key drivers contribute to the decline in hare populations. Intensification of agriculture has led to habitat loss, particularly affecting the availability of suitable habitats for hares.

Urbanization and the expansion of road networks have further fragmented their habitats. Additionally, soil, water, and air pollution, as well as ongoing climate change, negatively impact hare reproductive processes. Predation also plays a crucial role in the population decline. Foxes, whose numbers have geometrically increased due to rabies vaccinations, are major predators of hares. Raccoon dogs, raccoons, birds of prey, and corvids also contribute to hare mortality. Poaching and other hunting-related damage, including the impact of synanthropic predators (such as outdoor domestic cats), exacerbate the situation (10, 12, 31, 32, 40, 51). Furthermore, infectious and parasitic diseases significantly affect hare health and survival. These diseases directly contribute to hare mortality rates (8, 22, 30, 33). The European hare (*Lepus europaeus*) is susceptible to several viral and bacterial diseases. Notably, brown hare syndrome (EBHS) and rabbit haemorrhagic disease virus (RHDV) caused by recombinant RHCV2 virus are most significant. The RHDV infections was previously excluded fromhares' possible infectious factors, however recently this thesis was proven wrong. In 2012, Italy reported the first case of RHDV2 infection in a hare. This virus accounts for approximately one-third of viral disease cases in European hares in France (25, 48). Additionally, hares are vulnerable to bacterial infections such as brucellosis, yersiniosis, tularemia, and staphylococcus. Parasitic diseases like echinococcosis, cysticercosis, and coccidiosis also pose a hudge risk for hares. Moreover, many of those diseases are considered dangerous zoonotic pathogens spreading when human comes in contact with both live or hunted hares as well as with their meat.

The hunting season for gray hares in Poland spans from November 1 to December 31, with group hunts involving a minimum of six hunters. The nutritional and culinary value of hunted hare carcasses is highly regarded. Game (game meat) of these animals is a highly valued food raw material.

The aim of the study was a preliminary assessment of the health of the European hare (*Lepus europaeus*) population living in the Lublin Upland based on macroscopic changes observed during a post-mortem examination.

Material and methods

A total of 85 European hares (*Lepus europaeus*) were included in the research, comprising 43 females and 42 males. This cohort consisted of 27 older individuals (over one year of age) and 58 young individuals (up to one year of age). The study involved deceased animals, specifically those legally shot according to Polish hunting regulations, therefore ethical committee approval was not required. The hares selected for research were obtained during a two-day collective hunt conducted in two hunting districts situated in the western part of the Lublin Upland.

During the initial phase of the study, a comprehensive external examination was conducted on each specimen intended for research. Sex and age were determined based on physical characteristics, body weight, and the Stroh method. The Stroh method involves palpating the thickening of the cartilage on the outer side of the ulna bone, approximately 1 cm from the wrist joint. Since this thickening disappears by the age of 8-9 months, it allows differentiation between young animals and adults (over 1 year of age). Additionally, the overall appearance, physical condition, and fur quality of each individual was assessed, while also checking for external signs indicative of disease took place.

Next, the animal was dissected, during which further examination was carried out and material in the form of internal organs and fecal samples was collected for further tests. The small and large intestines, feces, spleen, liver, heart, lungs and a fragment of the diaphragm were collected. Each of these organs was carefully separated and packed into separate sterile packages and described by an assistant who was not actively involved in the autopsy. After the dissection and removal of the digestive tract and internal organs, the cleaned, unskinned carcasses were hung and secured in a transport refrigerator for better bleeding and cooling. When diagnosing brucellosis, pathologically enlarged testicles, scrotal swelling, and fistulas in males were observed. In females, we noted enlargement of the uterus, often with mummified fetuses inside, inflammation of the uterus, and purulent foci under the skin along the linea alba. Additionally, there were discernible changes in the liver, lungs, intestines, and spleen, characterized by purulent or necrotic foci, located individually or scattered.

In cases of yersiniosis, attention is drawn to multifocal caseous necrotic foci visible on the spleen, liver, intestines, and mesenteric lymph nodes. These outbreaks were typically small, ranging from the size of a pinhead to a grain of beans, and may coalesce.

Characteristic changes associated with tularemia include necrotic alterations in the kidneys, liver, and spleen. The spleen appears swollen and dark cherry red, while the liver shows congestion and enlargement with small necrotic foci. Pericarditis is a typical organ change, and lung abscesses occur less frequently.

Echinococcosis, caused by the hydatid tapeworm (*Echinococcus granulosus*), primarily affected parenchymal organs, especially the liver. Cysts were found within the liver tissue, varying in number and size. Alveococcosis (multilocular echinococcosis), caused by the tapeworm *Echinococcus multilocularis* in hares, results in infiltrative lesions in various internal organs, including the liver, lungs, and brain.

Hare cysticercosis, caused by *Taenia pisiformis cysticerci*, is manifested as numerous visible cysts in the liver. Occasionally, these cysts also appear in the heart muscle and lungs, exhibiting characteristic lesions of varying sizes and shapes. The parasite tends to cluster in the anus and mesentery.

The observed macroscopic changes in the form of: pathologically enlarged testicles, scrotal swelling, changes in the liver, lungs, intestines, spleen, and uterus located focally and diffusely were also collected for further examination, recorded, described and documented photographically.

Carcasses and internal organs of individuals suspected of being infected with zoonotic diseases were secured with special precautionsand, after collecting material for testing, sent for disposal.

The results were subjected to statistical analysis, calculating average values and the percentage of animals with disease symptoms in the total number of hares examined.

Results and discussion

The research findings concerning the prevalence of diagnosed diseases in European hares (*Lepus europaeus*) based on macroscopic post-mortem examinations, stratified by age and sex, are summarized in Table 1.

Tab. 1. Number of hares with macroscopic disease symptoms after necropsy (n = 85)

Sex	Females		Males	
Age	Mature	Immature	Mature	Immature
Brucellosis	0	1	2	3
Rodentiosis	0	9	1	1
Tularemia	0	1	2	0
Echinococcosis	2	0	2	1
Cysticercosis	3	1	6	1
Number of hares examined	10	34	24	17

Among the 85 animals examined, 32 exhibited post-mortem lesions, accounting for 37.6% of the population. Conversely, 53 animals (62.4% of the total sample) displayed no clinical signs of disease. Notably, the cohort with clinical changes exhibited specific pathological findings: brucellosis in 6 hares, rodentiosis in 11, tularemia in 3, echinococcosis in 5, and cysticercosis in 11. Additionally, four individuals displayed concurrent symptoms of two of the aforementioned diseases.

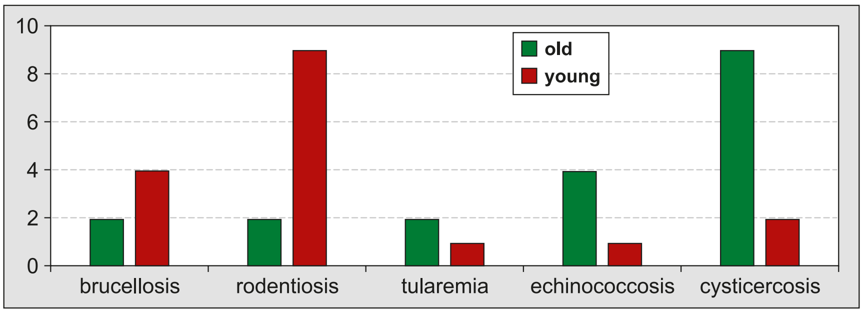

Fig. 1. Percentage distribution of macroscopically detected disease entities in individuals with disease symptoms detected during autopsy (n = 36)

Figure 1 illustrates the percentage distribution of individual disease entities identified through autopsy. Rodentiosis and cysticercosis were the most frequently detected diseases. These findings suggest a higher prevalence of these conditions in the hare population within a specific environment, which serves as their reservoir. Furthermore, the examined hares appear to be more susceptible to these particular diseases. Scientific research supports the notion that the elevated incidence of rodentiosis may be linked to specific natural reservoirs and vectors within a given geographical region. Additionally, other researchers posit that cysticercosis is more prevalent in hares due to the tapeworms' extensive life cycle and their widespread occurrence in the environment (18). The impact of age on disease occurrence in hares is depicted in Figure 2.

Studies reveal that an animal's age significantly influences the presence of specific disease entities, as confirmed by macroscopic changes observed during post-mortem examinations. Analyzing the age distribution of affected individuals reveals distinct patterns. Young hares exhibit a higher susceptibility to brucellosis and rodentiosis compared to the older individuals. Previous research indicates that the immature immune system of young animals renders them more prone to brucellosis infections (4). Similarly, rodentiosis is more frequently observed in young hares, likely due to increased exposure to risk factors during their initial months of life. Interestingly, our research diverges from existing literature regarding tularemia. While other studies emphasize a higher incidence of this disease in young individuals (11), our findings suggest a greater occurrence of tularemia in older hares. This discrepancy may be attributed to the limited sample size and the specific research area. Conversely, echinococcosis and cysticercosis are more prevalent in older hares. Echinococcosis is often diagnosed in older animals due to its longer incubation period and gradual development of echinococcal cysts (49). Moreover, cysticercosis, too, is more common in older hares, likely resulting from prolonged exposure to infectious tapeworm stages and the accumulation of larvae in tissues over time.

Brucellosis, caused by Gram-negative bacilli of the genus *Brucella*, is an infectious bacterial disease with

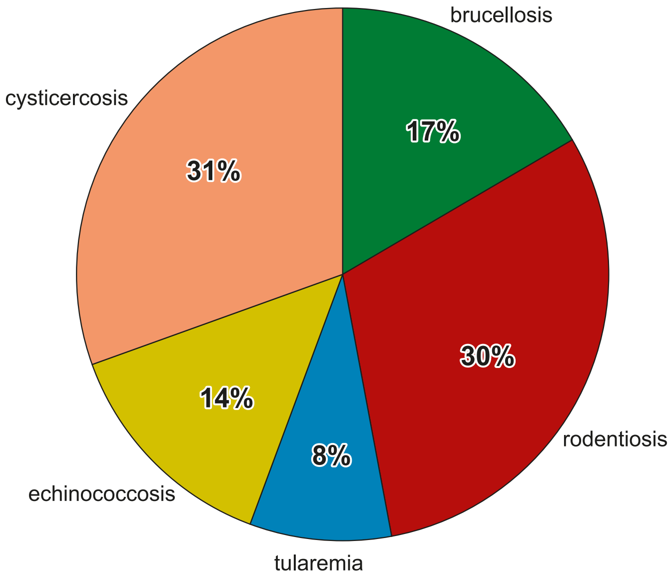

Fig. 2. The occurrence of diseases confirmed by macroscopic autopsy depending on the age of the examined hares (n = 36)

zoonotic properties. It is included in the list of infectious diseases by the World Organization for Animal Health (OIE). The disease affects both domestic and wild animals, including moose, foxes, deer, roe deer, wild boars, and European hares. In hares, brucellosis is primarily caused by persistent, Gram-negative *Brucella suis biovar 2* bacteria (14, 45). The initial transmission of this disease likely occurred from domestic cattle herds (*Bos taurus*) to free-roaming animals. Strict biosecurity measures in farm animal facilities have reduced the threat to free-living animals. Currently, European hares (*Lepus europaeus*) and wild boars (*Sus scrofa*) serve as the main reservoirs of *Brucella suis biovar 2* in European regions, posing a risk of transmission to farm animals and humans (14).

The modes of disease transmission among animals include contact with infected or sick animals, consumption of contaminated feed, exposure to fetal membranes, and contact with infected fetuses during mating and insemination procedures (16). The primary route of pathogen transmission is through the ingestion of aborted fetuses and fetal membranes by animals (23). Additionally, transmission can occur via mucous membranes. Brucellosis may manifest as either an acute or chronic course. Post-mortem examinations typically reveal numerous necrotic purulent granulomas within the reproductive system and local lymph nodes (24).

In animals, brucellosis is manifested with typical clinical signs such as abortions, retained placenta, orchitis, epididymitis, and arthritis. This disease poses a common complication for both humans and other animals, leading to infertility. The economic impact of brucellosis outbreaks is significant in countries facing numerous cases.

In humans, the most frequently observed symptom is intermittent fever, characterized by alternating periods of normal body temperature and life-threatening spikes (1). Seroprevalence of brucellosis increases with age and sexual maturity. Infected female hares often suffer from miscarriages, retained placenta, infertility, uterine inflammation, and tumors. In males, inflammation and swelling of the testicles, epididymis, and scrotum result in infertility. Autopsies of infected hares reveal swollen lymph nodes, skin tumors, and, in pregnant females, dead fetuses in the uterus (35). Notably, sex hormones and mesoerythritol in testes and semen, along with erythritol in female allantoic fluid, stimulate Brucella growth and multiplication (34).

Our research identified six sectioned hares with macroscopic changes indicative of brucellosis: pathologically enlarged testicles, scrotal swelling, and lesions in the liver, lungs, intestines, spleen, and uterus, localized focally and scattered.

Suspected brucellosis in shot animals necessitates immediate implementation of appropriate sanitary and veterinary measures due to the high infection risk. Definitive diagnosis relies on detailed bacteriological tests, PCR, or ELISA results. Meat from brucellosis-

Fig. 3. Enlargement of the testicles in a hare as a change in advanced brucellosis (photo J. Kowalczyk)

infected animals is considered unfit for consumption (16). Despite ongoing efforts, there is currently no effective vaccine for humans or animals. Existing vaccines have limitations, emphasizing the need for continued research to develop an ideal brucellosis vaccine. Such a vaccine should induce long-lasting immunity and protect against various Brucella strains, ensuring safety and efficacy across affected species (26).

Yersiniosis, also known as rodentiosis, is a bacterial disease caused by *Yersinia pseudotuberculosis*, a Gram-negative bacillus that is facultatively anaerobic and belongs to the Enterobacteriaceae family (13). According to the regulation of the Ministry of Agriculture and Rural Development (May 18, 2004), this disease is classified as a zoonosis subject to mandatory registration.

Historically, yersiniosis was diagnosed in 18.5% of hares shot in Poland between 1960 and 1962 (47). However, current research indicates that the disease still persists in the natural environment. German studies found that as many as 89.6% of European hare individuals in Germany exhibit seroprevalence of pathogenic Yersinia (2).

Clinical symptoms of yersiniosis include shortness of breath and acute or chronic diarrhea. Post-mortem findings reveal multifocal caseous necrosis in the spleen, liver, intestines, and mesenteric lymph nodes (24). Rodents are considered the primary reservoir for this disease (3). Conditions favoring Yersinia development include cool temperatures and persistently high humidity (50). These conditions are prevalent in Poland during autumn-winter and winter-spring seasons, coinciding with decreased natural food availability and increased animal stress. Consequently, native hare populations experience an upsurge in yersiniosis cases (14).

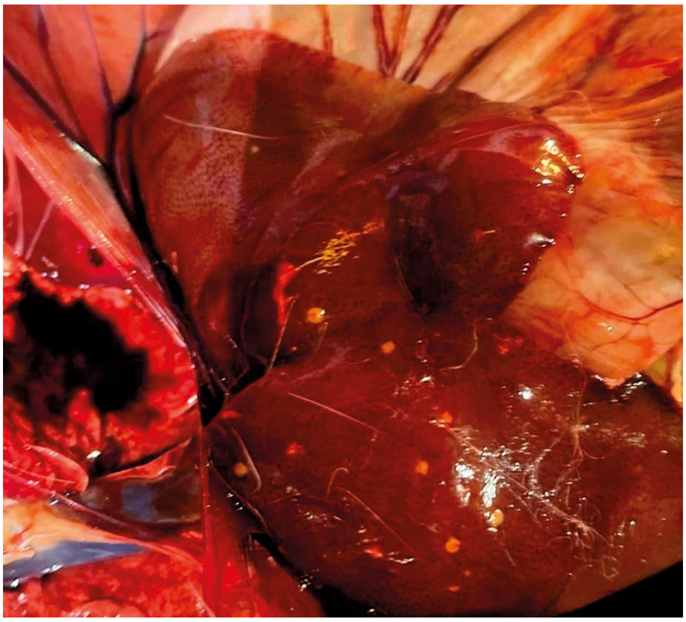

Fig. 4. Lesions on the liver in a hare with yersiniosis (photo J. Kowalczyk)

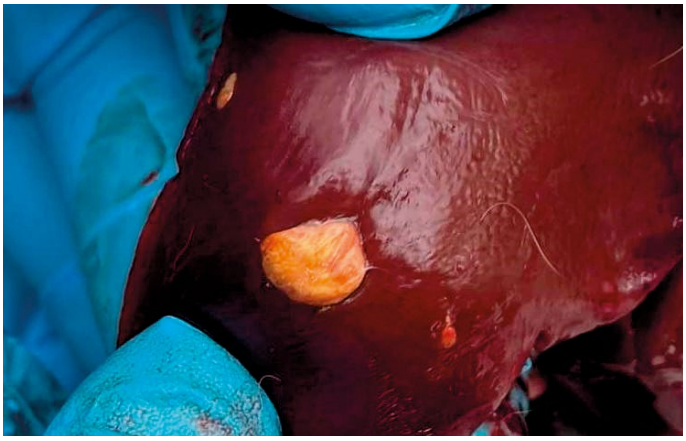

Fig. 5. Changes in the kidney of a hare with tularemia (photo J. Kowalczyk)

Although every hare likely encounters these pathogens, not all individuals develop the disease (24). Yersiniosis-related losses in hare populations average around 50% (52). A German study on 230 European hares (*Lepus europaeus*) revealed a seroprevalence of pathogenic Yersinia (*Y. pseudotuberculosis* and *Yersinia enterocolitica*) at 89.6%. This high infection frequency necessitates further research on the pathogen's impact on declining wild hare populations in Europe since the 1950s (2, 41).

Autopsies in our research identified yellow necrotic liver lesions in 11 examined individuals. Common changes associated with the disease include an enlarged spleen with necrotic foci (resembling beans) and similar alterations in the kidney cortex.

For definitive diagnosis, bacteriological analysis of fecal samples is currently employed in hares, although its reliability is limited due to slow bacterial growth (13). Humans can contract yersiniosis through contact with infected animal feces, urine, or meat. The gastrointestinal tract and damaged skin serve as portals of infection, particularly during carcass handling. After an incubation period, humans may develop various forms of the disease: intestinal (affecting over ¾ of infected individuals), pre-appendicular (characterized by sharp abdominal pain), septic (rare but severe), or extraintestinal (inflammation of joints, peripheral lymph nodes, and renal glomeruli) (16).

Tularemia is a zoonotic disease caused by highly infectious, immobile, relatively aerobic, Gram-negative bacteria *Francisella tularensis*, which does not have the ability to move and produce spores. The main reservoir of this disease are lagomorphs. After Franciella enters the host's body, the bacterium travels through the lymphatic vessels to the lymph nodes, where it multiplies. After the incubation period, the disease process spreads to other organs and becomes generalized. Infected individuals usually do not survive, but those that do survive are not carriers. Ticks mainly act as carriers and reservoirs. In hares and wild rabbits, tularemia manifests itself with fever, loss of appetite, lethargy, weakness, heart rhythm and breathing disorders, and swollen lymph nodes. In the final stage of the disease, ataxia of movement occurs, mainly in the hind limbs. Animals usually die within 1-3 days (16). The incubation period lasts from 3 to 7 (14) days, it may take the acute form, i.e. hemorrhagic sepsis, which occurs most often in the population of hares, or chronic, in which we observe loss of body weight and general weakness.

Evidence of infection has been found in lagomorphs, rodents, carnivores, ungulates, marsupials, insectivores, birds, amphibians, fish, and invertebrates (36). These pathogens are sensitive to high temperatures, but when the ambient temperature drops, they are able to survive for a long time. This is particularly important in terms of proper processing and storage of hare carcasses, because freezing does not destroy them. They can survive in frozen meat for up to 4 months (44). Transmission occurs through direct contact, aerogenic, alimentary and indirect contact: infected food or via vectors (blood-sucking insects, ticks). Possible forms of the disease are: ulcerative-nodal, angina, gastrointestinal, pulmonary, oculo-nodal, typhoid. Most cases of infection lead to fatal sepsis. A characteristic symptom is point necrosis in the liver, spleen and lymph nodes (3). In Poland, tularemia was first diagnosed in a human in 1949. Its source was hare skin (21). A five-year study conducted in the Netherlands in 2011-2016 on 106 hare representatives showed the presence of F. Tularensis in 3 samples (19) In the same year, an increase in infections among humans and free-living animals was recorded in Germany. Among 179 hares tested, positive results were obtained in 55 animals (42). So far, there has been no data in Poland on the epidemiological status of the wild hares population and the prevalence of this disease. Bacteriological diagnosis of tularemia requires biological safety class 2 (BSL-2) conditions. It is performed on samples including aspirates and biopsies of lymph nodes, scrapings of skin lesions, blood

Fig. 6. Changes in the intestines of a hare with cysticercosis (photo J. Kowalczyk)

and urine samples, material from the gastrointestinal tract, and samples of contaminated water and food (39). When conducting serological tests, it is worth remembering that cross-reactivity with *Brucella* spp., *Proteus* OX19 and *Yersinia* spp. occurs (28, 29).

During anatomopathological autopsies, our own research revealed necrotic changes on the kidneys, liver and swelling of the spleen in 3 individuals. Typical organ changes in the course of this disease include pericarditis and, in less numerous cases, lung abscesses (35).

The final diagnosis of tularemia relies on evaluating anatomopathological changes and conducting bacteriological examinations (47). Consumption of meat from infected animals is not recommended. Tularemia is listed by the World Organization for Animal Health (OIE) and is subject to registration requirements in Poland under the Act of March 11, 2004, which addresses animal health protection and infectious animal diseases (Journal of Laws, April 20, 2004). Additionally, tularemia is included in the list of infectious diseases and human infections since December 2008. Human infection can occur through direct contact with sick animals, inhalation, or consumption of contaminated water and food (16).

Fig. 7. Lesions in the internal organs of a hare with echinococcosis (photo J. Kowalczyk)

Echinococcosis, caused by the *Echinococcus granulosus* tapeworm, is a highly dangerous parasitic zoonosis worldwide. Canids, primarily dogs, serve as definitive hosts, harboring the parasite in their small intestines. The invasive eggs are excreted in feces. Intermediate hosts include farm animals (sheep, goats, pigs, cattle, and horses) and small forest mammals (including hares), which become infected through contaminated food or water. Larval cysts develop in parenchymal organs, primarily the liver (15). These cysts can grow large and numerous, leading to organ atrophy due to increased abdominal pressure. Definitive hosts typically remain asymptomatic. Our research identified changes associated with unilocular echinococcosis in 5 examined hares. Diagnosis occurs post mortem. For definitive hosts, classic parasitological techniques are employed, followed by PCR confirmation. In intermediate hosts, serological methods are effective (7).

Alveococcosis, also known as multilocular echinococcosis, results from infection with the tapeworm *Echinococcus multilocularis.* The primary definitive hosts for this parasite are foxes, where adult forms reside in the intestines. The tapeworm body consists of 5-7 segments, measuring 1.2 to 4.5 mm in length. The final segment, the uterine segment, contains 200 to 600 spherical eggs, each equipped with three pairs of embryonic hooks (16). Lagomorphs (such as hares) and rodents serve as the main intermediate hosts, acquiring infection by ingesting the tapeworm eggs. Once ingested, the oncosphere is released and migrates to the liver, where it develops into a metacestode. Over several weeks to months, it gains the ability to infect definitive hosts. Unlike definitive hosts (which remain asymptomatic), intermediate hosts develop alveococcosis, a serious disease.

Autopsy examinations in cases of multilocular echinococcosis reveal the presence of alveococci in internal organs, including the liver, lungs, and brain. Although alveococcosis is common among animals in northern Europe, human cases are rare. It is considered one of the most dangerous parasitic diseases and is listed among infectious diseases and human infections covered by the Act on preventing and combating infections and infectious diseases in humans (December 3, 2008) (16).

Hare cysticercosis is a parasitic disease caused by *Taenia pisiformis cysticerci. T. pisiformis* is a heteroxenic parasite belonging to the Plathelminthes class (Eucestoda, Cyclophyllidea, Taeniidae). In its life cycle, adult forms reside in the small intestine of dogs and felids, while the larval stage (cysticercosis) occurs in the serous membranes of body cavities and viscera in lagomorphs (such as hares) and rodents, resulting in the infection known as cysticercosis (20).

The liver is the primary organ predisposed to pathological changes. Although cysticercosis is often asymptomatic in lagomorphs, some cases exhibit reduced fertility. In Iberian hares (*Lepus sekretensis*), a negative correlation with the kidney fat index has been observed (17). Severe infections can lead to symptoms related to liver damage due to parasite migration and subsequent inflammation.

The definitive hosts (typically dogs and foxes) shed eggs in their feces, which contaminate the environment. Hares become infected by ingesting materials contaminated with these eggs. Once ingested, the egg hatches into a parasite that penetrates the intestinal wall and migrates via portal veins to the selected organ. The embryo undergoes growth, cavitation, and differentiation, forming the second larval stage (vesicular worm). This stage consists of a fluid-filled bladder containing a scolex called a cysticercus. The cysticercus surrounds the liver capsule or other abdominal serosal surfaces and is eventually ingested by the definitive host (37).

Animals acquire the parasite by consuming feed or water contaminated with *T. pisiformis* eggs. The developing larva (metacestode or cysticercus) is typically found in the peritoneal cavity and mesentery, and occasionally in other organs such as the heart and lungs. Granulomatous changes in the liver can lead to economic losses due to liver confiscation during slaughter. *T. pisiformis* shares reproductive, morphological, antigenic, and molecular characteristics with other taenid species, including *T. hydatigena*, *T. taeniaformis*, *T. crassiceps*, and *T. solium* (17). The parasite load does not significantly correlate with the age or sex of hares.

Although there is currently no specific data on increased hare cysticercosis incidence, a trend of excess disease occurred in Europe in the previous decade. In northern Italy in 2008, a rapid decline in hare populations was associated with an increase in *T. pisiformis cysticerci*-infected individuals, with subsequent research revealing a prevalence of 14.8% in 2013 and 3.28% in 2015 (43).

Studies conducted in Bulgaria between 2009 and 2016 aimed to determine the frequency of cysticercosis in local hare populations. The frequency of *T. pisiformis* infection was found to be 16.8% (46). Notably, Mexico currently experiences a high incidence of the disease, with a parasite prevalence of 67.7% reported in 2018 (9).

In cases of cysticercosis, the parasite larvae are typically visible in the liver and occasionally in the heart muscle, forming characteristic cysts of varying sizes and shapes. If cysts are abundant in internal organs or muscles, carcasses are considered unsuitable for consumption and cannot be released for trade. Proper disposal is necessary. Cysticercosis is common in Poland and is classified as a zooanthroponosis, meaning it can be transmitted to humans (Rajský et al., 2016). Our own research identified cysticercosis in hares in eleven cases, highlighting the widespread occurrence of this parasite in the tested area.

Fig. 8. Changes in the intestines of a hare with cysticercosis (photo J. Kowalczyk)

The conducted research has confirmed the European hare (*Lepus europaeus*) as an important reservoir for various pathogens. Our own autopsy-based study revealed that many hunters lack awareness of diseases and their associated symptoms, leading to potential risks when handling infected carcasses.

European hares play a significant role in maintaining endemic levels of zoonotic diseases. Our research not only highlighted disease symptoms encountered during hare evisceration after hunting, but also raised awareness among hunters about the risks associated with handling such lesions. Game diseases pose both an epizootic problem due to the spread of infectious agents, including zoonotic pathogens, and a sanitary and hygienic threat related to the assessment and handling of hunted animal meat.

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