Bovine besnoitiosis Fact Sheet

1. Disease overview

Besnoitia besnoiti causes besnoitiosis, a parasitic disease which affects cattle. It is still unclear how besnoitiosis is transmitted under natural conditions. The most likely way of transmission within cattle herds is mechanical transmission by biting insects. An infection can progress asymptomatically, but can also lead to general illness, followed by a chronic disease, characterized by skin lesions and sand-like cysts in the mucous membranes and connective tissues (Lahondes, 2025).

Besnoitiosis is not a WOAH-notifiable disease, and it is not listed in the EU AHL.

2. Agent

Besnoitia besnoiti is a cyst-forming, obligate intracellular protozoan, belonging to the phylum Apicomplexa (family Sarcocystidae) (Lahondes, 2025; Coelho, 2023).

Besnoitia besnoiti parasites have different life stages. Tachyzoites are the proliferative stage and are present in the host species during acute disease. They are 6-7.5 x 2.5-3.9 µm and can reside in within many different host cells. Bradyzoites are 6.0-7.5 x 1.9-2.3 µm and they persist in tissue cysts in chronically infected animals. Tissue cysts can contain hundreds of parasites (Cortes, 2014).

3. Geographical Distribution

Besnoitia besnoiti has been reported in Africa, South America and Asia and is emerging in Europe (Oryan, 2025). It has spread in Portugal, Spain, France, Greece and Ireland, and outbreaks have been reported in Germany, Italy, Hungary, Switzerland and Belgium (Oryan, 2025; DeLooz, 2021; Basso, 2013; EFSA, 2010; and references in the online version).

Infection with *Besnoitia besnoiti* is not reportable to WOAH. Evidence from published studies describing natural infections with this agent, as well as field epidemiological studies, are collected in the EFSA's systematic literature review (updated until 31/12/2025) and summarized in Figure 1. For more detailed information and dynamic maps, visit the online disease profile (accessible via the button in the top right corner).

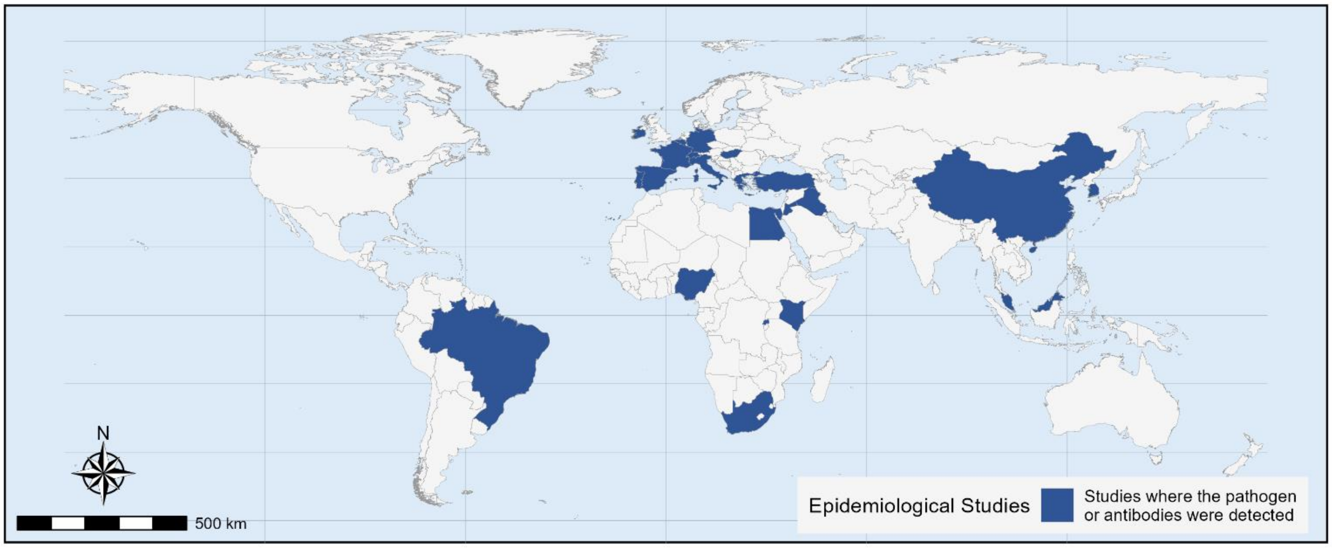


Figure 1. Geographical distribution of epidemiological studies addressing the occurrence of *Besnoitia besnoiti*, as identified by the EFSA's systematic literature review (covering years 1970-2025)..

4. Animal hosts

4.1. Susceptible hosts

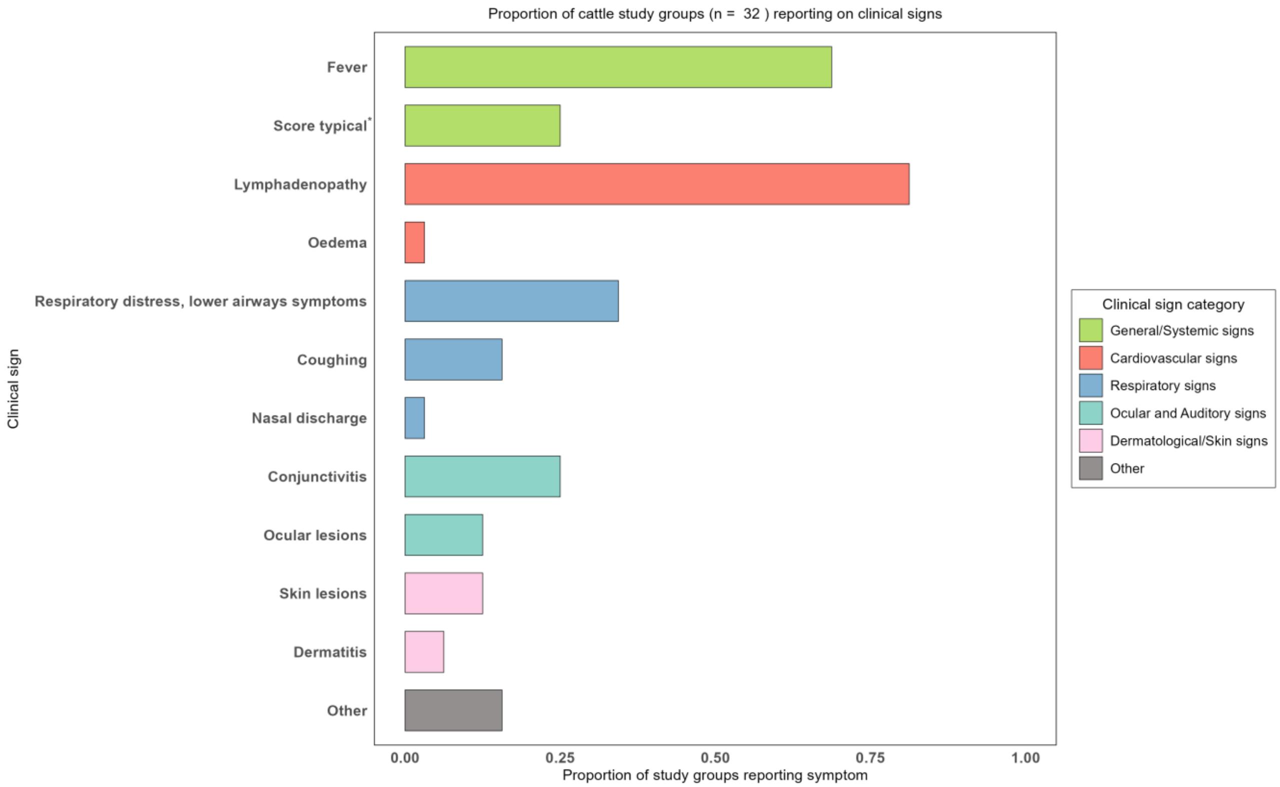
Based on epidemiological knowledge of host–pathogen–vector interactions and outbreak reports, the main hosts of *B. besnoiti* are domestic ruminants. However, other species have been identified in the SLR. The SLR summary is given in Table 1.

Table 1. Susceptible host species of *Besnoitia besnoiti*.

The systematic literature review reported in the *B. besnoiti* disease profile, identified the following susceptible species (updated until 31/12/2025, for references see online disease profile)
FIELD
Epidemiological studies carried out in the field **Pathogen was detected in the following animal species:** • Bovidae: *Bos taurus* **Antibodies were detected in the following animal species:** • Bovidae: *Bos taurus, Ovis aries, Bos grunniens, Bubalus* bubalis • Cervidae: *Cervus elaphus, Capreolus capreolus* **Outbreaks reported to WOAH included the following species:** • No species specified
EXPERIMENTS
Experimental studies demonstrated infection in: • Bovidae: *Bos taurus* • Felidae: *Felis catus* • Leporidae: *Oryctolagus cuniculus*

4.2. Clinical Signs

Outcomes of a systematic literature review on clinical signs in 32 cattle groups are displayed in Figure 2. Most study groups showed general and cardiovascular clinical signs.



*Score typical: visible scleral tissue cysts. The SLR was updated until 31/12/2025, for references see the online disease profile.

Figure 2. Clinical signs reported in the main hosts of *B. besnoiti*.

Clinical signs in cattle develop in different phases. After infection, an acute phase is seen, which is caused by multiplication of tachyzoites. Affected animals have high fever (above 40°C) and show non-specific signs like depression, weight-loss, photophobia, nasal and ocular discharge, lymph node swelling and decreased milk production. Oedema, with general swelling of the whole body, can be seen. Seven to 14 days after the start of the acute phase, a chronic phase develops, caused by cyst formation in the mucous membranes and connective tissues. These cysts can be seen by the naked eye in the conjunctiva, sclera, lips and vulval mucosa. Cyst forming can lead to hyperkeratosis, alopecia, folding of the skin and sometimes even shedding of the epidermis (elephantiasis/elephant skin). Male animals can become infertile because of necrotizing orchitis. (Lahondes, 2025, Oryan, 2025, SLR)

4.2.1. Incubation Period

The incubation period in cattle varies from 6 to 13 days (Jacquiet, 2010; DeLooz, 2015; Oryan, 2015). In experimental infections in cattle, the incubation period varied between 1 day and 40 days (references in the online version).

4.2.2. Morbidity and case fatality

Most infected animals remain asymptomatic, with cysts in the mucous membranes as only visible sign (Oryan, 2025; Lahondes, 2025; EFSA, 2010). A small proportion of infected animals develop clinical signs, varying from 1-10% in endemic regions to 15-20% in emerging regions (Lahondes, 2025). Severely affected animals might die. The mortality rate during the chronic stage is around 10% (Oryan, 2025, EFSA, 2010).

4.2.3. Zoonotic Potential

Besnoitia besnoiti is not known to infect humans under natural conditions.

5. Transmission

It is still unclear how besnoitiosis is transmitted under natural conditions. It is assumed that it has an indirect life cycle, with a yet unidentified definitive host that is shedding oocysts.

The most likely way of transmission within cattle herds is mechanical transmission by biting flies. Also, transmission via direct contact between animals with ruptured cysts on mucous membranes or skin lesions might be possible. Another option might be iatrogenic transmission when needles are reused. *B. besnoiti* has been found in bull's semen, so natural mating might also play a role in transmission. (Lahondes, 2025; EFSA, 2010; Oryan, 2025).

Since most clinical signs are seen in summer, when cattle herds are out on the pasture and blood-sucking flies are most active and present, mechanical transmission by these insects seems to be a likely scenario.

For more information on vector distribution, visit the *Vector* section in the online disease profile.

6. Diagnostic tests

As the disease is not WOAH-listed, there are no WOAH-recommended diagnostic tests.

In the acute phase of the infection, it can be difficult to diagnose the disease, due to non-specific clinical signs. Characteristic clinical signs appear when tissue cysts start to develop in the chronic phase. Then, the disease can be diagnosed by histopathology of a skin biopsy. This method is considered the gold standard (Lahondes, 2025; Oryan, 2025; EFSA, 2010). In acutely infected animals, conventional PCR or real-time PCR from skin samples are more sensitive than serological methods, because in this phase no antibodies have been developed yet. However, in sub-clinically infected animals, with a low number of cysts, PCR might give a negative result (Oryan, 2025).

Indirect methods, detecting specific antibodies in the serum of infected animals, can be used for diagnosing clinical and subclinical infections. The immunofluorescent antibody test (IFAT) can be used for serological testing. It is more sensitive and specific than ELISA. However, ELISA tests are more appropriate when testing larger numbers of samples in epidemiological studies and diagnosing besnoitiosis in herds. It is recommended to confirm samples that test positive in ELISA with Western blot, because ELISA testing might result in false-positives due to cross-reactions with other Apicomplexan parasites (Lahondes, Oryan).

Table 2 presents data on the sensitivity and specificity of diagnostic tests collected through EFSA's systematic literature review; reported values correspond to the median sensitivity and specificity when multiple study groups investigated the same test and are only included when explicitly stated in the publications.

Table 1. Median sensitivity and specificity of tests to detect *B. besnoiti*/*B. besnoiti* antibodies reported in literature included in the systematic literature review.

Target	Test	Species	Sensitivity	N animal groups	Specificity	N animal groups	References
Antigen	ELISA	Cattle	91.7%	3	97.7%	3	García-Lunar et al., 2017
Antigen	ELISA	Wild ruminants	95.7%	1	96.8%	1	García-Lunar et al., 2017
Antibody	ELISA	Cattle	88.3%	9	97.6%	9	Cortes et al., 2006; García-Lunar et al., 2013
Antibody	Immunoblot	Cattle	90.0%	1	100%	1	Schares et al., 2010
Antibody	I-ELISA	Cattle	100%	1	100%	1	Fernández-García et al., 2010
Antibody	IFAT	Cattle	91.9%	5	95.4%	5	García-Lunar et al., 2013
Antibody	Western blot	Cattle	90.2%	17	98.3%	17	Cortes et al., 2006; García-Lunar et al., 2013

7. Prevention and control

7.1. Vaccination

There is no licensed vaccine available in Europe. Some countries (Israel, South Africa) have used live attenuated vaccines. They protect animals from clinical disease, but do not prevent the introduction of B. besnoiti into naïve herds. Also, live attenuated vaccines could lead to introduction of the parasite into free herds and vaccinated animals can become carriers of the parasite (Alvarez-García et al., 2013; Cortes et al., 2014, de Vos and Bock, 2000).

7.2. Treatment

There is currently no effective treatment for besnoitiosis in cattle (Lahondes, 2025; Oryan, 2025). It was found that oxytetracycline (OTC) prevented the development of orchitis in experimentally infected rabbits. OTC also seemed to have some therapeutic potential against the disease. OTC also prevented death in infected gerbils (Oryan, 2025; Shkap, 1985; Shkap, 1987).

8. References

Alvarez-García G, Frey CF, Mora LM, Schares G. A century of bovine besnoitiosis: an unknown disease re-emerging in Europe. Trends Parasitol. 2013 Aug;29(8):407-15. doi: 10.1016/j.pt.2013.06.002

Basso W, Lesser M, Grimm F, Hilbe M, Sydler T, Trösch L, Ochs H, Braun U, Deplazes P. Bovine besnoitiosis in Switzerland: imported cases and local transmission. Vet Parasitol. 2013 Dec 6;198(3-4):265-73. doi: 10.1016/j.vetpar.2013.09.013.

Basso W, Schares G, Gollnick NS, Rütten M, Deplazes P. Exploring the life cycle of Besnoitia besnoiti - experimental infection of putative definitive and intermediate host species. Vet Parasitol. 2011 Jun 10;178(3-4):223-34. doi: 10.1016/j.vetpar.2011.01.027.

Coelho J, Domingues J, Waap H, Stilwell G. Epidemiological characteristics of bovine besnoitiosis (Besnoitia besnoiti) in a beef cattle farm: a cross-sectional serological assessment. Front Vet Sci. 2023 Apr 26;10:1158235. doi: 10.3389/fvets.2023.1158235.

Cortes, H.C.E., Nunes, S., Reis, Y., Staubli, D., Vidal, R., Sager, H., Leitão, A., Gottstein, B. (2006). Immunodiagnosis of Besnoitia besnoiti infection by ELISA and Western blot Veterinary Parasitology, 141(3-4), 216

Cortes H, Leitão A, Gottstein B, Hemphill A. A review on bovine besnoitiosis: a disease with economic impact in herd health management, caused by Besnoitia besnoiti (Franco and Borges,). Parasitology. 2014 Sep;141(11):1406-17. doi: 10.1017/S0031182014000262

De Vos, A.J. and Bock, R.E. (2000), Vaccination against Bovine Babesiosis. Annals of the New York Academy of Sciences, 916: 540-545. https://doi.org/10.1111/j.1749-6632.2000.tb05333.x

Delooz L, Evrard J, Mpouam SE, Saegerman C. Emergence of Besnoitia besnoiti in Belgium. Pathogens. 2021 Nov 23;10(12):1529. doi: 10.3390/pathogens10121529.

EFSA. Bovine besnoitiosis: An emerging disease in Europe. EFSA Journal 2010; 8(2):1499

Férnandez-García, A., Álvarez-García, G., Risco-Castillo, V., Aguado-Martínez, A., Marcén, J.M., Rojo-Montejo, S., Castillo, J.A., Ortega-Mora, L.M. (2010). Development and use of an indirect ELISA in an outbreak of bovine besnoitiosis in Spain. Veterinary Record, 166(26), 818

García-Lunar, P., Ortega-Mora, L.M., Schares, G., Gollnick, N.S., Jacquiet, P., Grisez, C., Prévôt, F., Frey, C.F., Gottstein, B., Álvarez-García, G. (2013). An Inter-Laboratory Comparative Study of Serological Tools Employed in the Diagnosis of Besnoitia besnoiti Infection in Bovines Transboundary and Emerging Diseases, 60(1), 59

García-Lunar, P., Ortega-Mora, L.M., Schares, G., Diezma-Díaz, C., Álvarez-García, G. (2017). A new lyophilized tachyzoite based ELISA to diagnose Besnoitia spp. infection in bovids and wild ruminants improves specificity Veterinary Parasitology, 244, 176

Jacquiet P, Liénard E, Franc M. Bovine besnoitiosis: epidemiological and clinical aspects. Vet Parasitol. 2010 Nov 24;174(1-2):30-6. doi: 10.1016/j.vetpar.2010.08.013.

Lahondes T, Carolino N, Sousa SR, Waap H, Martins EG. Retrospective study of bovine besnoitiosis in the Auvergne Rhône-Alpes region in France. Front Vet Sci. 2025 Aug 21;12:1621589. doi: 10.3389/fvets.2025.1621589.

Oryan A, Ahmadi A, Kamali A, Hajjafari A. Global impact of emerging besnoitiosis on cattle: Effects on production, fertility, and economic losses with an update on worldwide Besnoitia infection. The Microbe, Volume 9, 2025, https://doi.org/10.1016/j.microb.2025.100590.

Schares, G., Basso, W., Majzoub-Altweck, M., Rostaher, A., Scharr, J.C., Langenmayer, M.C., Selmair, J., Dubey, J.P., Cortes, H.C., Conraths, F.J. (2010). Comparative evaluation of immunofluorescent antibody and new immunoblot tests for the specific detection of antibodies against Besnoitia besnoiti tachyzoites and

bradyzoites in bovine sera Veterinary Parasitology, 171(1-2), 32

Shkap V, De Waal DT, Potgieter FT. Chemotherapy of experimental Besnoitia besnoiti infection in rabbits. Onderstepoort J Vet Res. 1985 Dec;52(4):289.

Shkap V, Pipano E, Ungar-Waron H. Besnoitia besnoiti: chemotherapeutic trials in vivo and in vitro. Rev Elev Med Vet Pays Trop. 1987;40(3):259-64.