



The importance of the Eurasian wild boar (*Sus scrofa*) as a reservoir of tuberculosis for free-living animals including European bison

Blanka Orłowska¹, Monika Krajewska-Wędzina², Anna Didkowska¹,
Krzysztof Anusz¹

¹ Department of Food Hygiene and Public Health Protection, Faculty of Veterinary Medicine, Warsaw University of Life Sciences, Warsaw, Poland

² Department of Microbiology, National Veterinary Research Institute, Puławy, Poland

Abstract: Cases of TB were recorded in European bison in the Bieszczady Mountains in 1997 – 2013. An alarming phenomenon, however, is a TB case in a wild boar from the Bieszczady. Transmission of TB between infected wild boars and European bison is potentially possible. The article is aimed at presenting the problem of the occurrence of TB in wild boar and the potential danger posed to European bison by this situation. The role of wild boar in TB transmission is not always clear (maintenance, spillover or dead-end host), and depends on various environmental conditions (e.g. population density, occurrence of tuberculosis in other species in the area, feeding, climate). The majority of cases of TB in Europe in wild boars have been reported in Mediterranean Iberia (Spain and Portugal).

Keywords: wild boar, European bison, the Bieszczady Mountains, tuberculosis transmission

Introduction

Tuberculosis (TB) is caused by an infection with various species of the *Mycobacterium tuberculosis* complex – MTBC (e.g. *M. caprae*, *M. bovis*). Both animals and humans are susceptible to MTBC infection. Inter- and intraspecies transmission is possible and multi-host system is typical for TB infections. In the Bieszczady Mountains in 1997-2013 cases of TB were recorded in European bison (Krajewska *et al.* 2015, 2017). An alarming phenomenon, however, is a TB case in a wild boar from the Bieszczady. (Krajewska *et al.* 2014). The strain (*M. caprae*) isolated from this wild boar had the same spoligotype and MIRU pattern as strains isolated previously from European bison from the herd of Górny San (the Bieszczady Mountains), which had been eliminated because of the TB. TB in wild boars in this area has not been recorded previously (Witkowski *et al.* 2017). Transmission of TB between infected wild boars and European bison is potentially possible. The article is aimed at presenting the problem of the occurrence of TB in wild boar and the potential danger posed to European bison by this situation.



Tuberculosis and the wild boar

Tuberculosis in wild boar is found in many European countries. The role of wild boar in TB transmission is not clear and is different in various regions. This species might be a spillover or dead-end host but also a true reservoir under certain conditions. The most cases of TB in Europe in wild boars have been reported in Mediterranean Iberia (Spain and Portugal). In this region, wild boar is a MTBC maintenance host. For example, in Doñana National Park in south-western Spain, MTBC infection prevalence in wild boars was 52%, and similarly high TB prevalence was recorded in other regions of Mediterranean Spain and Portugal (Gortazar *et al.* 2008, Vieira-Pinto *et al.* 2011, Gortazar *et al.* 2012). It is probably related to the Mediterranean habitats with dry summers, which causes animals to gather at a few remaining water and feeding sources (Gortazar *et al.* 2012). Moreover, in Mediterranean Spain, contrary to Atlantic, TB prevalence in cattle and wild boar population density are higher (Muñoz-Mendoza *et al.* 2013). All this may contribute to intra- and interspecies TB transmission.

The role of wild boar in TB transmission is less important in Iberian Atlantic Spain, France, Italy, England and throughout most of Europe (Gortazar *et al.* 2012, Muñoz-Mendoza *et al.* 2013). In Iberian Atlantic Spain, Muñoz-Mendoza *et al.* (2013) found a low MTBC prevalence (2.6%) and a higher proportion of atypical mycobacteria (MAC) infection (4.5%). Only 16.7% of MTBC infected wild boars displayed generalized TB lesions. In France, wild boar is considered as TB spillover host and most TB cases in this species are found in areas where TB is also diagnosed in cattle (Payne *et al.* 2016). The majority of the MTBC strains isolated from animals came from cattle (88%) and only 9% from wild animals (wild boar, badgers, red deer) (Hauer *et al.* 2015).

Hardstaff *et al.* (2014) found that in Europe the most common TB host system is cattle-deer-wild boar. Similarly, Muñoz-Mendoza *et al.* (2013) revealed molecular (spoligotyping and MIRU pattern) epidemiological links between wild boar and other animals (cattle, goat, sheep, badger and red fox).

In TB affected wild boar, lesions are frequently seen in head lymph nodes (LNs), particularly the mandibular or the retropharyngeal LNs (Martín-Hernando *et al.* 2007; Zanella *et al.* 2016), however, different organs may be affected. Generalized and severe infections are often seen in juveniles (Gortázar *et al.* 2008; Santos *et al.* 2009). Extensive TB lesions in many organs (e.g. lungs) may be the cause of mycobacteria excretion to the environment.

Conclusion

The role of wild boar in interspecies TB transmission may be different in various ecosystems. More research on the prevalence of TB among wild animal populations

in the Bieszczady Mountains is needed to determine the exact role the wild boar may play in the transmission of this disease (maintenance, spillover or dead-end host).

References

- Gortázar C., Torres M.J., Vicente J., Acevedo P., Reglero M., de la Fuente J., Negro J.J., Aznar-Martín J. 2008. Bovine tuberculosis in Doñana biosphere reserve: the role of wild ungulates as disease reservoirs in the last Iberian lynx strongholds. *PloS ONE*, 3:e2776. 10.1371/journal.pone.0002776.
- Gortázar C., Delahay R.J., McDonald R.A., Boadella M., Wilson G.J., Gavier-Widen D., Acevedo P. 2012. The status of tuberculosis in European wild mammals. *Mammal Review* 42:193–206.
- Hardstaff J.L., Marion G., Hutchings M.R., White P.C. 2014. Evaluating the tuberculosis hazard posed to cattle from wildlife across Europe. *Research in Veterinary Science* 97: 86–93.
- Hauer A., De Cruz K., Cochard T., Godreuil S., Karoui C., Henault S., Bulach T., Banuls A.L., Biet F., Boschirolu M.L. 2015. Genetic evolution of *Mycobacterium bovis* causing tuberculosis in livestock and wildlife in France since 1978. *PLoS One* 10: e0117103.
- Krajewska M., Lipiec M., Zabost A., Augustynowicz-Kopeć E., Szulowski K. 2014. Bovine tuberculosis in a wild boar (*Sus scrofa*) in Poland. *Journal of Wildlife Disease* 50:1001–1002.
- Krajewska M., Zabost A., Welz M., Lipiec M., Orłowska B., Anusz K., Brewczyński P., Augustynowicz-Kopeć E., Szulowski K., Bielecki W., Weiner M. 2015. Transmission of *Mycobacterium caprae* in a herd of European bison in the Bieszczady Mountains, Southern Poland. *European Journal of Wildlife Research* 61:429–433.
- Krajewska-Wędzina M., Koziońska M., Orłowska B., Weiner M., Szulowski K., Augustynowicz-Kopeć E., Anusz K., Smith N.H. 2017. Molecular characterisation of *Mycobacterium caprae* strains isolated in Poland. *Veterinary Record* doi: 10.1136/vr.104363
- Martín-Hernando M.P., Höfle U., Vicente J., Ruiz-Fons F., Vidal D., Barral M., Garrido J.M., de la Fuente J., Gortázar C. 2007. Lesions associated with *Mycobacterium tuberculosis* complex infection in the European wild boar. *Tuberculosis* 87:360–367.
- Muñoz-Mendoza M., Marreros N., Boadella M., Gortázar C., Menéndez S., de Juan L., Bezos J., Romero B., Copano M.F., Amado J., Sáez J.L., Mourelo J., Balseiro A. 2013. Wild boar tuberculosis in Iberian Atlantic Spain: a different picture from Mediterranean habitats. *BMC Veterinary Research* 9:176
- Payne A., Philipon S., Hars J., Dufour B., Gilot-Fromont E. 2016. Wildlife interactions on baited places and waterholes in a French area infected by bovine tuberculosis. *Frontiers in Veterinary Science* 3: 122.
- Santos N., Correia-Neves M., Ghebremichael S., Källenius G., Svenson S.B., Almeida V. 2009. Epidemiology of *Mycobacterium bovis* infection in wild boar (*Sus scrofa*) from Portugal. *Journal of Wildlife Diseases* 45:1048–61.
- Vieira-Pinto M., Alberto J., Aranha J., Serejo J., Canto A., Cuhna M.V., Botelho A. 2011. Combined evaluation of bovine tuberculosis in wild boar (*Sus scrofa*) and red deer (*Cervus elaphus*) in central-east Portugal. *European Journal of Wildlife Research* 57:1189–1202.

- Witkowski L., Orłowska B., Rzewuska M., Czopowicz M., Welz M., Anusz K., Kita J. 2017. Evidence of low prevalence of mycobacterial lymphadenitis in wild boars (*Sus scrofa*) in Poland. *Acta Veterinaria Scandinavica* 59:9 DOI 10.1186/s13028-017-0277-0
- Zanella G., Duyauchelle A., Hars J., Moutou F., Boschioli M.L., Durand B. 2008. Patterns of lesions of bovine tuberculosis in wild red deer and wild boar. *Veterinary Record* 163:43-7.

Znaczenie dzika jako rezerwuaru gruźlicy dla zwierząt wolno żyjących z uwzględnieniem żubra

Streszczenie: W Bieszczadach w latach 1997- 2013 notowano przypadki gruźlicy u żubrów. Niepokojącym zjawiskiem jest jednak stwierdzenie tej choroby u dzika z Bieszczad. Transmisja prątków gruźlicy między zakażonymi dzikami a żubrami jest potencjalnie możliwa. Artykuł ma na celu przybliżenie problemu występowania gruźlicy dzików i potencjalnego zagrożenia jakie ta sytuacja stwarza dla żubrów. Rola dzików w transmisji gruźlicy nie zawsze jest jasna i zależy od różnych uwarunkowań środowiskowych (np. zagęszczenie populacji, występowanie gruźlicy u innych gatunków, dokarmianie, klimat). Najwięcej przypadków gruźlicy u dzików w Europie stwierdza się w rejonach śródziemnomorskich (Hiszpanii i Portugalii).
