EXTERNAL REFERENCES

ID SCREEN® PARATUBERCULOSIS INDIRECT

Last update: September 2023

Publications / References:

BOVINE

CATTLE SERUM

1)Caldow G. L. *et al.* (2023). **Estimation of the specificity of an antibody ELISA for paratuberculosis generated from a sector of the UK cattle population using results from a paratuberculosis control program**. Preventive Veterinary Medicine, 215, 105910.	• A voluntary program to control paratuberculosis in cattle based on herd management and serological screening has been applied for five years using the ID SCREEN® PARATUBERCULOSIS INDIRECT (confirmation test was either liquid culture or PCR). • *Results*: The overall **specificity** for the five years of testing, which included **143 804 antibody ELISA results** was **0.9989** with a 95 % confidence interval of 0.9987–0.9991. Of the 79,252 animals that were tested and included in the study 41,835 were tested in one year only 20,064 were tested in two years; 9844 were tested in three years; 5236 in four years and 2273 animals were tested in each of the five years; therefore while animals were tested in multiple years, in year 5 when 33,438 animals were tested, the overlap with animals tested in year one accounted for 0.068 of the animals tested. ***These results are consistent with the previously reported specificity estimates, but achieve greater precision, because of the very much larger test population and the demonstration of consistent findings across the five years of the study*. (sic)**			Epidemiological study		Specificity data
2)Corbiere F. *et al.* (2023). **Effects of Silirum®-Based Vaccination Programs on Map Fecal Shedding and Serological Response in Seven French Dairy Herds**. Animals, 13(9), 1569.	• The effects of the whole cell heat killed Silirum® vaccine on *Mycobacterium avium subsp. paratuberculosis* shedding in the feces and serological response (using the ID SCREEN® PARATUBERCULOSIS INDIRECT) were studied in a controlled field study involving seven dairy herds, where calves were vaccinated at various ages. 358 vaccinated and 265 non-vaccinated control cows were sampled. The serological status (ELISA) was assessed				Vaccination monitoring	

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	over 3 years. The total number of samples collected per cow was typically between 1 and 3. • *Results*: 13.0% (n = 151) of serum samples were positive for Map antibodies, and 1.7% (n = 20) were doubtful. The proportion of positive or doubtful results was significantly higher among vaccinated animals (23.7%) than among non-vaccinated animals (3.8%).					
3)Kolivand A. *et al*. (2023). **Comparison to Methods; Serum Antibody ELISA and Fecal Nested-PCR to Diagnose *Mycobacterium avium Subspecies Paratuberculosis* Subspecies Infection in Cattle**. Journal of Veterinary Research/Majallah-i Taḥqīqāt-i Dāmpizishkī University, 78(1).	• This study aimed to compare the sensitivity, and specificity of the ID SCREEN® PARATUBERCULOSIS INDIRECT and a nested PCR for the detection of *Mycobacterium avium subspecies paratuberculosis* infection in dairy cattle. • *Results*: Out of the total 2203 serum samples, 112 were positive (5.1 %) and 2091 were negative (94.9 %) using the ID SCREEN® PARATUBERCULOSIS INDIRECT. The results of Nested-PCR tests of rectal feces showed that out of 59 cows with positive results in serum ELISA, 47 (79.7 %) samples were positive, and 12 (20.3 %) samples were negative. Moreover, out of 31 cattle with negative results on the ELISA test, 15 (48.38%) and 16 (51.62%) had positive and negative results on the feces samples' nested PCR tests. ***Due to the low sensitivity of PCR compared to ELISA, the positive and negative predictive values, and the accuracy of ELISA test, as well as the high cost and time-consuming nature of PCR and the need for more and more complex facilities than ELISA, the authors concluded that ELISA is a more suitable method for screening and epidemiological studies than PCR.* (sic)**	Correlation with other techniques				Performance evaluation
4)Echeverria G. *et al*. (2020). **Prevalence of paratuberculosis in dairy cattle in Ecuador**. The International Journal of Mycobacteriology, 9(1), 1-6.	• 600 blood samples from dairy cattle were processed using the ID SCREEN® PARATUBERCULOSIS INDIRECT. Fecal samples of the seropositive cows were processed for culture. • *Results*: 150 bovines (25%) resulted in seropositive; culture confirmed the presence of MAP in 4.7% (7/150) of the seropositive cows. 80% of the fecal samples of seropositive cows did yield MAP, and some samples shedded non-tuberculous mycobacteria species including *M. avium subsp. avium*.			Epidemiological study		
5)Sharma M. L. *et al.* (2019). **Demonstration of Circulating Antibodies of *Mycobacterium avium* Subspecies *paratuberculosis* in Cattle of Rupandehi District, Nepal**. Nepalese Veterinary Journal, 36, 23-29.	• 184 blood samples from cattle were tested using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: Overall seroprevalence was found to be 4.89%.			Epidemiological study		

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6)Fox N. J. *et al.* (2018). **Counterintuitive increase in observed *Mycobacterium avium subspecies paratuberculosis* prevalence in sympatric rabbits following the introduction of paratuberculosis control measures in cattle**. Veterinary Record, 182(22), 634-634.	• Rabbits are naturally infected with the same Map strain as cattle and can excrete high levels in their feces. The aim of this study was to determine if the implementation of paratuberculosis control in cattle leads to a decline in Map infection levels in rabbits. 2609 cattle sera were tested using the ID SCREEN® PARATUBERCULOSIS INDIRECT and Map was detected in rabbits by fecal culture (4 years study). • *Results*: Map seroprevalence in cattle decreased from 16 to 7.2 percent, while Map prevalence in rabbits increased from 10.3 to 20.3 percent. Results indicate that efforts to control paratuberculosis in cattle do not reduce Map levels in sympatric rabbits. ***There is no evidence that a decrease in paratuberculosis prevalence in cattle is associated with a decrease in Map prevalence in rabbits in this study*. (sic)**			Epidemiological study		
7)Galiero A. *et al.* (2017). **Serological survey of paratuberculosis in dairy cattle in Garfagnana district (Tuscany)**. Journal of the Hellenic Veterinary Medical Society, 68(4), 641-646.	• 162 cattle sera were analyzed using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: True seroprevalence was 29.1% at the herd level and 4.6% at the animal level.			Epidemiological study		
8)Shaughnessy R.G. *et al.* (2015) **Analysis of Biobanked Serum from a *Mycobacterium avium subsp paratuberculosis* Bovine Infection Model Confirms the Remarkable Stability of Circulating miRNA Profiles and Defines a Bovine Serum miRNA Repertoire**. PLoS ONE 10(12): e0145089.	• Analysis of an experimental MAP infection to explore the prognostic potential of miRNA profiles in cattle defined as seropositive for anti-MAP antibodies compared against seronegative cattle. The ID SCREEN® PARATUBERCULOSIS INDIRECT was used to screen 20 calves orally infected with MAP and a set of 10 certified negative animals. • *Results*: On 6 experimentally challenged animals, seroconversion was observed in one animal at 10 weeks post-infection and in another one at 15 weeks post-infection. After 22 months, results suggest a correlation between serology and fecal culture diagnostics for these 2 animals. No clear evidence of seropositivity with the other experimentally infected cattle. **In well-defined infecting conditions, the ID SCREEN® PARATUBERCULOSIS INDIRECT allows showing seroconversion in 2/6 cattle.**		Correlation with other techniques		Experimental infection	

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9)Brugel C. *et al*. (2014). **Facing interpretation difficulties of positive serology in presupposed paratuberculosis-free herds: longitudinal study and result comparison of commercial ELISAs**. Poster presented at the 12th ICP – International Colloquium on Paratuberculosis – Parma, Italy.	• Longitudinal study of three well-controlled and closed herds with no clinical signs of paratuberculosis, and with annual serological surveillance for at least 10 years. The ID SCREEN® PARATUBERCULOSIS INDIRECT was evaluated in comparison to another commercial ELISA kit. • *Results*: The ID SCREEN® PARATUBERCULOSIS INDIRECT shows a better specificity than the other commercial kit.			Epidemiological study		Performance evaluation
10)Comtet L. *et al*. (2014). **Use of the interferon gamma release assay for the detection of *Mycobacterium avium subsp. paratuberculosis* infection**. Poster presented at the 12th ICP – International Colloquium on Paratuberculosis – Parma, Italy – June 2014.	• The aim of this study is to assess the specificity and sensitivity of IGRA stimulation antigens developed by IDvet in infected herds with different profiles of infection. Serology was assessed using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: Detection of MAP in infected herds was improved by combining IGRA and the ID SCREEN® PARATUBERCULOSIS INDIRECT.	Correlation with other techniques				Performance evaluation
11)Verité S. *et al*. (2014). **Paratuberculosis ELISAs: improvements on the horizon?** Poster presented at the 12th ICP – International Colloquium on Paratuberculosis – Parma, Italy – June 2014.	• Comparison from different Paratuberculosis ELISA manufacturers and/or batches (including the ID SCREEN® PARATUBERCULOSIS INDIRECT), in field conditions. **Samples with high S/P% were generally found positive by PCR. The ID SCREEN® PARATUBERCULOSIS INDIRECT should be used to detect and eliminate heavy shedders giving high S/P% values, most responsible for disease spread.**	Correlation with other techniques				Performance evaluation
12)Medeiros J.M.A. *et al*. (2012). **Frequência de anticorpos para paratuberculose em bovinos no semiarido paraíbano**. Pesq. Vet. Bras. 32(8):697-700. (in Portuguese).	• Frequency of antibodies against paratuberculosis using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: The prevalence in two farms with cases of the disease was 72.22% (13/18) and 68.75% (11/16).			Epidemiological study		
13)Pozzato N. *et al.* (2010). **Evaluation of four commercial serum ELISA kits for the detection of bovine paratuberculosis: an interlaboratory and field trial**. Poster at the Epizone Meeting 2010, Saint-Malo, France	• Four ELISA tests (including the ID SCREEN® PARATUBERCULOSIS INDIRECT) were evaluated: determination of the robustness in an interlaboratory trial and evaluation of diagnostic sensitivity and specificity on field samples. • *Results*: the ID SCREEN® PARATUBERCULOSIS INDIRECT gave 100% of the expected results (n=256). Observed specificity was 100% and observed sensitivity was 69.7%.	Correlation with other techniques				Performance evaluation

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14)Fry M. *et al*. (2008). **Evaluation of four commercial enzyme-linked immunosorbent assays for the diagnosis of bovine paratuberculosis in Chilean dairy herds**. J Vet Diagn Invest 20:329-332	• The accuracy of 4 commercial ELISAs (including the ID SCREEN® PARATUBERCULOSIS INDIRECT) for diagnosis of bovine paratuberculosis was compared using sera from 53 *Mycobacterium avium subsp. paratuberculosis* fecal culture–positive dairy cows and sera from 345 dairy cattle residents in 11 fecal culture–negative herds. • *Results*: **The ID SCREEN® PARATUBERCULOSIS INDIRECT specificity was estimated at 99.42%. The observed sensitivity was 41.5% (the best sensitivity among the four ELISAs tested). Receiver operating characteristic (ROC) curve analysis and the corresponding area under the ROC curves (0.944) indicate that the ID SCREEN® PARATUBERCULOSIS INDIRECT had the highest overall accuracy.**	Correlation with other techniques				Performance evaluation
15)Köhler H. *et al*. (2008). **Evaluation of five ELISA test kits for the measurement of antibodies against *Mycobacterium avium subspecies paratuberculosis* in bovine serum**. Berl. Münch. Tierärztl. Wochenschr. 121, Heft 5/6, 203-210.	• Five commercially available ELISA tests for the detection of antibodies against *Mycobacterium avium subsp. paratuberculosis* in bovine serum (including the ID SCREEN® PARATUBERCULOSIS INDIRECT) were evaluated at the individual animal level using sera from 286 paratuberculosis-free and 110 paratuberculosis-infected dairy cattle. • *Results*: **The ID SCREEN® PARATUBERCULOSIS INDIRECT specificity was estimated at 99.3%.** The overall observed sensitivity was 58.3%. The observed sensitivity was 77.4% for clinically infected animals, and 41.4% for latently infected animals (**the best sensitivity among the five commercial ELISAs tested**).					Performance evaluation

CATTLE MILK

16)Kirkeby C. *et al*. (2016). **Simulating the Epidemiological and Economic Impact of Paratuberculosis Control Actions in Dairy Cattle**. Front. Vet. Sci. 3:90.	• Description of a new mechanistic bio-economic model for simulating the spread of MAP within a dairy herd. All lactating animals from 102 random farms with no control action against MAP were tested using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: Test-and-cull is the most profitable action for low-hygiene herds.				Predictive model	
17) Kirkeby C. *et al*. (2016). **Adaptive Test Schemes for Control of Paratuberculosis in Dairy Cows**. tPLoS ONE 11(12) e0167219.	• Herd simulation model using the ID SCREEN® PARATUBERCULOSIS INDIRECT on milk samples in dairy cows. • *Results*: The optimal test scheme is a short sampling interval (3 months) when the prevalence is above 1% and a long sampling interval (1 year) when the prevalence is below 1%.				Predictive model	

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18)Lavers C. J. *et al*. (2014). **Evaluation of milk ELISA for detection of *Mycobacterium avium subspecies paratuberculosis* in dairy herds and association with within-herd prevalence**. Journal of Dairy Science, 97(1), 299-309.	• Evaluation of the herd-level test characteristics of 3 commercial milk ELISA including the ID SCREEN® PARATUBERCULOSIS INDIRECT (kit C). A total of 32 purposively selected herds with a median herd size of 66 milking cows were used in this 2-year project. Fecal cultures were performed and tested using PCR. • *Results*: Based on pooled fecal culture (PFC) results collected over the 2-year study period, the 32 herds included in the study were sorted out as follows: 14 were MAP+ and 18 were MAP-. The milk of each cow in the 32 herds has been tested with the 3 tests. In the MAP− herds (n=18), 29%, 13%, and 18% of herds had at least 1 milk ELISA-positive cow for ELISA A, B, and C, respectively. In the MAP+ herds (n=14), 71, 67, and 78% of herds had at least 1 cow milk ELISA-positive for ELISA A, B, and C, respectively. Herd-level sensitivity (HSe) and specificity (HSp) were assessed for different within-herd prevalence: 1%, 2%, and 3% (i.e., for a cut-off of 1%, if 1% of cows or more in the herd has a positive result on milk with ELISA, the herd is considered positive). Using a cut-off of 2% (meaning that the herd is considered positive only if 2% or more cows give a milk-ELISA positive result), HSe and HSp are the following: ELISA A: HSe = 59%; HSp = 80% ELISA B: HSe = 56%; HSp = 96% ELISA C (the ID SCREEN® PARATUBERCULOSIS INDIRECT): HSe = 63%; HSp = 92%. In the MAP+ group, the mean prevalence of MAP with fecal culture analysis was 6.2%. In the same group, tests on milk with ELISA gave the following within-herd prevalence: ELISA A = 2.9% / ELISA B = 3.0% / the ID SCREEN® PARATUBERCULOSIS INDIRECT = 4.0%. **The ID SCREEN® PARATUBERCULOSIS INDIRECT offers better herd sensitivity. Herd specificity level varies a lot between the 3 commercial ELISAs, and the ID SCREEN® PARATUBERCULOSIS INDIRECT gives a very good one (lower measured HSp is due to the higher intrinsic diagnostic sensitivity of the test). Moreover, in a MAP-positive group, the ID SCREEN® PARATUBERCULOSIS INDIRECT gives a more accurate within-herd prevalence regarding fecal culture results.**			Epidemiological study		Performance evaluation
19)Micheloud J.F. *et al*. (2014). **Diagnóstico de paratuberculosis bovina en la cuenca lechera del valle de Lerma, Salta**. XX Reunión científico Técnica. Tucumán, Argentina (in Spanish).	• Paratuberculosis seroprevalence survey in dairy cows using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: 26% (7/27) of cattle herds are positive for MAP antibodies.			Epidemiological study		

20)Nielsen S. *et al*. (2014). **Bulk tank milk ELISA for detection of antibodies to *Mycobacterium avium subsp. paratuberculosis*: Correlation between repeated tests and within-herd antibody-prevalence**. Preventive Veterinary Medicine. 11396-102.	• Bulk tank milk was tested repeatedly using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: The BTM S/P% was significantly associated with the within-herd prevalence ($p < 0.0001$) with a regression coefficient Beta of 12.2. The between-test date-autocorrelation was 0.80 (95% confidence interval: 0.76–0.83) when the within-herd test prevalence was not considered by the model used, while it was 0.60 (95% confidence interval: 0.53–0.67) when the within-herd prevalence was included in the model. **The present study demonstrated that the BTM antibody level was significantly associated with the within-herd prevalence of antibody-positive animals and repeated measurements of BTM antibody level were relatively highly correlated.**			Epidemiological study		
21)Nielsen S. *et al*. (2013). **Dynamics of Specific Anti-*Mycobacterium avium Subsp. paratuberculosis* Antibody Response through Age**. Plos One, Vol. 8, Issue 4, e63009.	• Age-specific sensitivity and specificity of the ID SCREEN® PARATUBERCULOSIS INDIRECT were estimated using test records from 18 972 dairy cows with MAP-specific IgG antibodies and test results from 166 905 cows, which had no MAP IgG antibodies. The proportion of MAP-infected cows developing humoral immune (HI) in their expected lifetime with HI responses at different ages was calculated. • *Results*: The specificity was estimated to be 0.987 (99% CI: 0.985–0.987); the sensitivity was 0.27 at 2 years of age and 0.74 at 5 years of age.			Epidemiological study		
22)Zervens L. M.L. *et al*. (2013). **Characterisation of an ELISA detecting immunoglobulin G to *Mycobacterium avium subsp. paratuberculosis* in bovine colostrum**. The Veterinary Journal 197, 889-891.	• The ID SCREEN® PARATUBERCULOSIS INDIRECT was used to determine the proportion of non-specific ELISA reactions in **colostrum samples**. • *Results*: Non-specific reactions were found in 3/365 (0.8%) of samples. The odds of an animal testing positive on the day of calving were 130 times higher than at 4 Days in Milk. **The findings suggest colostrum samples may have enhanced diagnostic potential over milk samples in determining if cattle have been exposed to or infected with MAP.** ***Technical reminder: In ruminants, IgG concentrations in milk and colostrum are 0.5 mg/ml and 60 mg/ml, respectively. Our test has been validated for use on milk samples only. The very high Ig concentration present in colostrum samples can lead to incorrect results.***		Particular matrix			Performance evaluation

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23)Nielsen S. *et al.* (2012). **Effect of days in milk and milk yield on testing positive in milk antibody ELISA to *Mycobacterium avium subsp. paratuberculosis* in dairy cattle**. Veterinary Immunology and Immunopathology 149) 6-10.	• This study assessed the effect of days in milk (DIM) and milk yield on testing positive in the ID SCREEN® PARATUBERCULOSIS INDIRECT among 222 774 cows. • *Results*: Odds of testing positive on 1–2 DIM were 9–27 times higher than the rest of lactation, where the chance of testing positive varied less. The reason is most likely a high concentration of non-specific antibodies in colostrum. **The inclusion of milk yield in the interpretation of test results could improve the diagnostic value, resulting in more predictable patterns corresponding to the progression of infection.**			Epidemiological study		
24)Thomsen V. *et al.* (2012). **Characterization of the long-term immune response to vaccination against *Mycobacterium avium subsp. paratuberculosis* in Danish dairy cows**. Veterinary Immunology and Immunopathology 145 316-322.	• A retrospective longitudinal study including 895 vaccinated and 2526 non-vaccinated dairy cows aiming at characterizing the long-term antibody-response to vaccination (using Neoparasec, a modified live vaccine based on MAP 316F or Mycopar,, a whole cell bacterin containing inactivated MAP) on the immune response. A secondary objective was to evaluate whether immunodiagnostics of MAP and *Mycobacterium bovis* infections were affected by MAP vaccination. The milk samples were tested using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: 37% of samples from vaccinated animals and 5% of samples from non-vaccinated animals, respectively, tested positive in the ID SCREEN® PARATUBERCULOSIS INDIRECT. The prevalence of antibody responses in the vaccinated animals was relatively constant from 2 to 6 years of age but decreased in older animals. **A large proportion of vaccinated cows do not have antibodies to MAP, and the humoral immune response to vaccination wanes with increasing age, suggesting that the effect of the vaccine diminishes over time.**			Epidemiological study	Vaccination monitoring	

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CATTLE MILK AND SERUM

25)Weber M. F. *et al*. (2022). **Predicting Positive ELISA Results in Dairy Herds with a Preferred Status in a Paratuberculosis Control Program**. Animals, 12(3), 384.	• The aim of the present study was to develop a predictive model to alert farmers with test-negative herds and preferred status in the Dutch paratuberculosis control program if they are at an increased risk of positive ELISA results in a subsequent 30-month period. Dairy herds participating in the Dutch milk quality assurance program for paratuberculosis are assigned a herd status based on herd examinations by ELISA (using the ID SCREEN® PARATUBERCULOSIS INDIRECT and another commercial kit) of individual serum (n=20977) or milk (n=737052) samples, followed by an optional confirmatory fecal PCR. • *Results*: based on the results of this study, discrimination of herds with high (52%) and low (17%) risks of positive ELISA results is feasible.			Predictive model		
26)Saad N. M. *et al*. (2018)**. Detection of *Mycobacterium avium subsp. paratuberculosis* in cow's milk.** Journal of Microbiology, Biotechnology and Food Sciences. 7 (6) 562-565.	• Both milk and blood samples of 88 suspected affected dairy cattle with paratuberculosis were collected from ten dairy farms. California Mastitis Test (CMT) was performed on milk samples. The ID SCREEN® PARATUBERCULOSIS INDIRECT was used for the detection of MAP antibodies in milk and serum samples. PCR was used for molecular identification of MAP from milk samples. • *Results*: 7.9%, 37.5%, 26, and 22 of 88 milk samples were CMT (++), CMT (+), suspicious and negative, respectively. According to ELISA results of milk samples, 27.3% and 72.7% were positive and negative, respectively. Based on the ELISA results of serum samples, it was found that 29.5%, 1.1%, and 69.3% were positive, suspicious, and negative, respectively. Concerning PCR of milk samples, MAP DNA was detected in 23.9% of samples.		Correlation with other techniques		Epidemiological study	

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27)Kennedy A.E. *et al*. (2016). **Analysis of Johne's disease ELISA status and associated performance parameters in Irish dairy cows**. BMC Veterinary Research 12:43.	• Epidemiological study to highlight the production losses associated with testing MAP positive using the ID SCREEN® PARATUBERCULOSIS INDIRECT in 3528 dairy cows (serum and milk samples). A new severe interpretation positive cut-off was applied to blood ELISA results only to achieve increased test sensitivity. Secondary objectives included the investigation of risk factors associated with testing. MAP ELISA positive in Irish dairy herds. The association between MAP ELISA status and production data was investigated using multi-level mixed models. Logistic regression was used to identify risk factors for testing JD blood ELISA positive at individual cow level and to identify associations between farm management practices and herd MAP status. • *Results*: Apparent prevalence was 7,4%. Mixed model analysis revealed no statistically significant association between testing MAP ELISA positive and dairy cow production parameters. Risk factors associated with testing positive included larger-sized herds being over twice more likely to test positive than smaller herds.			Epidemiological study		Performance evaluation
28)McAloon C.G. *et al.* (2016). **Bayesian estimation of prevalence of paratuberculosis in dairy herds enrolled in a voluntary Johne's Disease Control Programme in Ireland**. Preventive Veterinary Medicine 128 95–100.	• Use of Bayesian estimation to estimate the true prevalence of paratuberculosis in dairy herds. Diagnostic testing on milk and serum samples was conducted using 3 commercial Elisa kits including the ID SCREEN® PARATUBERCULOSIS INDIRECT.			Epidemiological study		
29)Kirkeby C. *et al*. (2015). **Mean effective sensitivity for *Mycobacterium avium subsp. paratuberculosis* infection in cattle herds**. BMC Veterinary Research 11:190.	• The ID SCREEN® PARATUBERCULOSIS INDIRECT was used to investigate the Mean Effective Sensitivity for groups of cattle (dairy and not dairy) to assist the decision-makers in MAP control programs. • *Results*: Generally, the groups with animals older than 2 years had a higher MES than the groups with young livestock. MES is also slightly higher for dairy herds than for non-dairy herds. **The study confirms the general opinion that testing young stock is not beneficial.**			Epidemiological study		

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30)INSTITUTO ZOOPROFILATTICO SPERIMENTALE DELLA LOMBARDIA E DELL'EMILIA ROMAGNA (2014). **Procedura aperta telematica finalizzata alla conclusione di un accordo quadro in unione di acquisto per la fornitura di kit per ricerca *Mycobacterium paratuberculosis***. Fascicolo n.1101. (in Italian).	• Validation study of three commercial kits for the detection of antibodies against MAP, including the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: **The ID SCREEN® PARATUBERCULOSIS INDIRECT presented the best performances**.					Performance evaluation
31)Kennedy A. *et al*. (2014). **The single intradermal cervical comparative test interferes with Johne's disease ELISA diagnostics**. Frontiers in Immunology. Vol. 5, Art. 564.	• The purpose of this study was to investigate the impact of SICCT on the prevalence of ELISA-positive results (serum and milk) in a herd, using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: "*Findings indicated that diagnostic sampling for JD utilizing milk ELISA should be avoided in the 43-day period following the bTB test, with serum ELISA sampling avoided 71 days post TB test*". (sic)					Performance evaluation

BUFFALOE SERUM

32)Martucciello A. *et al*. (2021). **Seroprevalence of paratuberculosis in Italian water buffaloes (*Bubalus bubalis*) in the region of Campania**. Journal of Dairy Science, 104(5), 6194-6199.	• 201 175 sera from buffaloes were tested using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: 54.7% of tested herds and 1.75% of all buffaloes tested positive for the ELISA test.				Epidemiological study	
33)Ricchi M. *et al*. (2018). **Evaluation of serological test for the detection of paratuberculosis in Italian buffaloes (*Bubalus bubalis*): a class latent approach**. Poster IPCV.	• Evaluation by a Bayesian two latent class model of the ID SCREEN® PARATUBERCULOSIS INDIRECT used for the detection of paratuberculosis in buffaloes (n=554). • *Results*: high specificity =98%; sensitivity =55%. **Performances of the ID SCREEN® PARATUBERCULOSIS INDIRECT are like those obtained for bovines.**				Epidemiological study	Performance evaluation

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34)Uy M.R. *et al*. (2018). **Serological and molecular evaluation of *Mycobacterium avium subspecies paratuberculosis* (Johne's disease) infecting riverine-type water buffaloes (*Bubalus bubalis*) in the Philippines.** Comparative Immunology, Microbiology and Infectious Diseases 61 24-29.	• Serological and molecular evaluation of MAP in 70 water buffaloes. The ID SCREEN® PARATUBERCULOSIS INDIRECT was used to detect the presence of MAP antibodies in sera. • *Results*: the ID SCREEN® PARATUBERCULOSIS INDIRECT showed a 2.48% infection rate although PCR showed 14,28%. **the ID SCREEN® PARATUBERCULOSIS INDIRECT is an ideal test for screening herds suspected of MAP; however, a PCR assay is needed to detect animals in the early phase of detection.**				Epidemiological study	
35)Desio G. *et al*. (2013). **Estimated prevalence of Johne's disease in herds of water buffaloes (*Bubalus bubalis*) in the province of Caserta**. Italian Journal of Animal Science, Vol. 12, N°1.	• Seroprevalence study of JD in water buffaloes using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: The true prevalence at the animal level and at the herd level was 4% and 74.1%, respectively.				Epidemiological study	

BUFFALOE MILK

36)Hafiz N.M. *et al*. (2016). **Detection of *Mycobacterium avium subsp. paratuberculosis* in raw buffaloe's milk**. Inter J ChemTech Res, 9, 123-8.	• 192 buffaloe milk samples were tested using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: 16 (8.3%) samples tested positive.				Epidemiology study	

SMALL RUMINANTS

37)Schrott J. *et al*. (2023). ***Mycobacterium avium subsp. paratuberculosis* in Sheep and Goats in Austria: Seroprevalence, Risk Factors and Detection from Boot Swab Samples**. Animals, 13(9), 1517.	• This study aimed to investigate the occurrence of paratuberculosis in sheep and goats by testing 22019 blood samples using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: The detected animal MAP seroprevalence was 2.0% for goats and 0.7% for sheep (calculated true prevalence 3.5% and 1.2%, respectively). Herd-level apparent MAP seroprevalence was 11.1% for goat herds and 8.9% for sheep flocks.				Epidemiology study	

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38)Arteche-Villasol N. *et al*. (2022). **Influence of heterologous and homologous vaccines, and their components, on the host immune response and protection against experimental caprine paratuberculosis**. Frontiers in Veterinary Science, 8, 744568.	• **This study analyzed the immune response and the effects on protection against Map infection, elicited by paratuberculosis (Silirum®)** and tuberculosis (heat-inactivated *M. bovis* [HIMB]) **vaccine**s and their components in a caprine experimental model. Fifty goat kids were divided into 10 groups (n = 5) according to their vaccination (Silirum®, HIMB and nonvaccinated), immunization (inactivated bacteria or adjuvant), and/or infection. **Oral challenge with bovine Map 764 strain was performed 45 days postvaccination/immunization (dpv), and animals were euthanized at 190 dpv**. **Peripheral immune response** and proportion of lymphocyte subpopulations were assessed monthly by the ID SCREEN® PARATUBERCULOSIS INDIRECT and flow cytometry analysis, respectively. Local immune response, PCR and histological examination were conducted in lymphoid tissues. Flow cytometry and ELISA results from peripheral IFN-g and antibody production were analyzed using **generalized lineal model (GLM) procedure** for evaluation of the main effects of vaccination, challenge, time, and its interaction. • *Results*: Both Map- and Mbv-specific antibody production reached significant levels from 60 to 190 dpv, respectively in Silirum and HIMB-vaccinated groups.	Correlation with other techniques			Experimental study	
39)Fernández M. *et al.* (2022). **Effects of Paratuberculosis Vaccination at Different Ages in a Dairy Goat Herd: A 2-Year Follow-Up**. Animals, 12(22), 3135.	• The objective of this study was to evaluate the effect of vaccination, depending on the age of the animals, on their immune response, the reduction of paratuberculosis cases, mortality, and culled animals in a commercial dairy herd. Goats (n=190) of three different ages were immunized with the inactivated Gudair® vaccine. Peripheral antibodies (using the ID SCREEN® PARATUBERCULOSIS INDIRECT) and IFN-Y output were evaluated for 21 months post-vaccination (mpv) and intradermal skin tests (IDSTs) for tuberculosis, with avian- and bovine-purified protein derivatives (PPD), were carried out at 6 and at 18 mpv to evaluate the humoral and cellular immune peripheral responses, respectively. The number of dead or culled animals, regardless of the reason, was also monitored and the causes of death were determined by pathological examination. • *Results*: Serum antibody levels increased between 3 and 21 mpv in all vaccinated groups. The highest levels were found in animals vaccinated at 5 months, and the lowest in adult individuals.	Correlation with other techniques			Experimental study	

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40)Yu Y. *et al*. (2022). **Identification of *Mycobacterium avium subspecies paratuberculosis* in sheep farms in Bayannaoer, Inner Mongolia, China**. BMC Veterinary Research, 18(1), 1-6.	• Serum samples from 472 individual sheep were obtained to detect antibodies against MAP using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: MAP antibodies were separately detected in 17.86% (35/196) and 18.48% (51/276) of sheep herds at approximately 6 months and ≥ 1 year of age, respectively.			Epidemiiology study		
41)Shabana I.I. *et al*. . (2020). **Sero-surveillance of *Mycobacterium avium subspecies paratuberculosis* infection in ruminants in Medina**. Journal of Advanced Veterinary and Animal Research, 7(1), 69.	• A total of 823 sera samples were collected from camels (n = 107), sheep (n = 492), and goats (n = 224). and 364 **milk samples** (from 123 sheep and 241 goats) were used to determine the incidence of *Mycobacterium avium subsp. Paratuberculosis* using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: In sera, MAP was more prevalent among sheep (55/492; 11.1%). The prevalence in goats was (31/224; 13.8%), while no infection was recorded among camels. The detection of MAP antibodies in milk revealed that 17 (13.8%) goats and 12 (4.9%) sheep were infected.		Particular matrix	Epidemiological study		
42)Iarussi F. *et al*. (2019). **Epidemiology and risk factors of *Mycobacterium avium subspecies paratuberculosis* in semi-extensive dairy sheep and goat farms of Apulia, southern Italy**. Small Ruminant Research, 177, 89-96.	• 16903 sheep sera and 9369 goat sera were tested using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: true seroprevalence of 66.2% for flocks and of 9.7% at the animal level, with significant differences between sheep (1.6%) and goats (24.9%).			Epidemiiology study		
43)Lievaart-Peterson K. *et al*. (2019). ***Mycobacterium avium subspecies paratuberculosis* DNA and antibodies in dairy goat colostrum and milk**. Veterinary Sciences, 6(4), 96.	• **Colostrum** and milk samples from dairy goats (2 sets) were tested for both antibodies against MAP (using the ID SCREEN® PARATUBERCULOSIS INDIRECT) as well as MAP DNA. • *Results*: Map antibodies were detected in 114 of the 120 (95%) colostrum samples from set I and in all 22 of the 22 colostrum samples from set II; MAP antibodies were detected in 96 (47%) of the 202 milk samples. ***Technical reminder: In ruminants, IgG concentrations in milk and colostrum are 0.5 mg/ml and 60 mg/ml, respectively. Our test has been validated for use on milk samples only. The very high Ig concentration present in colostrum samples can lead to incorrect results.***		Particular matrix	Epidemiiology study		

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44)Ma J.G. *et al*. (2019). **First report of bovine viral diarrhea virus and *Mycobacterium avium subspecies paratuberculosis* infection in Tibetan sheep (*Ovis aries*) in Tibetan Plateau, China**. Tropical animal health and production, 51, 719-722.	• 2187 blood samples from sheep were tested for MAP antibodies using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: The overall prevalence was 11.29%.			Epidemiology study		
45)Cecchi F. *et al*. (2018) **Preliminary association analysis of microsatellites and *Mycobacterium avium subspecies paratuberculosis* infection in the native Garfagnina goats**. JOURNAL OF APPLIED ANIMAL RESEARCH, VOL. 46, NO. 1, 879–882.	• The aim of this study is to investigate possible genetic influences on the susceptibility or resistance of goats to MAP. To select sheep for genotyping from a flock infected with MAP, animals were screened with the ID SCREEN® PARATUBERCULOSIS INDIRECT. The positive samples were subsequently tested with the ID SCREEN® PARATUBERCULOSIS INDIRECT confirmation ELISA. The diagnosis was achieved by post-mortem examination. • *Results*: 27 MAP-positive goats have been identified among 289 animals. **the ID SCREEN® PARATUBERCULOSIS INDIRECT can be used to screen flocks infected with MAP to compare genetic parameters in negative and positive populations.**			Epidemiological study		
46)Galiero A. *et al*. (2017). **Serological, culture and molecular survey of *Mycobacterium avium paratuberculosis* in a goat flock in Tuscany**. Folia Microbiol DOI 10.1007/s12223-017-0518-7 # Institute of Microbiology, Academy of Sciences of the Czech Republic.	• The aim of this study was to examine a flock of 294 goats performing ELISA, culture, and PCR assays. Firstly, the ID SCREEN® PARATUBERCULOSIS INDIRECT was performed, then positive samples were tested with the ID Screen® Paratuberculosis Indirect confirmation ELISA. • *Results*: seroprevalence was 6,8%.			Epidemiological study		
47)Mathevon Y. *et al*. (2017). **Estimation of the sensitivity and specificity of two serum ELISAs and one fecal qPCR for diagnosis of paratuberculosis in sub-clinically infected young-adult French sheep using latent class Bayesian modeling**. BMC Veterinary Research, 13, 1-11.	• The objective was to evaluate the diagnostic accuracy of the ID SCREEN® PARATUBERCULOSIS INDIRECT, another commercial ELISA kit, and one quantitative PCR on feces for the diagnosis of paratuberculosis in sub-clinically infected young-adult sheep. Serology was performed on 1197 individual blood samples**. Separate analyses were performed for four scenarios using latent class Bayesian modeling**, according to whether doubtful ELISA results were handled as positive or negative and on the choice of the positive cut-off for faecal qPCR. • *Results*: The best fit to the data was provided by accounting for a pairwise dependence between the two ELISAs on sensitivity and pairwise dependence between the three tests on specificity. Under this model, the estimated **ELISA sensitivities were 17.9%** and 17.4%, with **estimated specificities of 94.8%** and 94.0% **for the**	Correlation with other techniques				Performance evaluation

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	ID SCREEN® PARATUBERCULOSIS INDIRECT and the other commercial ELISA kit. Faecal qPCR demonstrated a sensitivity of 47.5%; and a specificity of 99.0%.					
48)Moioli B. *et al*. (2016). **Genomic scan for identifying candidate genes for paratuberculosis resistance in sheep**. Animal Production Science, 56, 1046–1055.	• To identify genes for paratuberculosis resistance in sheep, 759 sheep from a flock infected with MAP were screened with the ID SCREEN® PARATUBERCULOSIS INDIRECT. A selective genotyping strategy was then applied by selecting two groups of positive and negative sheep. • *Results*: 32 genomic regions were made evident for encoding polymorphic markers with a significant effect on the S/P value indicating paratuberculosis positivity. **the ID SCREEN® PARATUBERCULOSIS INDIRECT can be used to screen flocks infected with MAP to compare different parameters in negative and positive populations.**			Epidemiological study		
49)Lafort M.P. (2015). **La paratuberculose chez les ovins: effet de la vaccination sur la réponse sérologique et l'excrétion fécale de *Mycobacterium avium subspecies paratuberculosis* (Map)** (Doctoral dissertation, in French).	• The objective of this thesis is to **study the effect of Gudair® vaccine on serological response** and fecal excretion of Map in cattle herds. Post-vaccination serological status was assessed with the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: A total of 96.1% of vaccinated animals (663 animals out of 690) were seropositive, indicating that vaccination results in a humoral immune response in almost all cases. In addition, these animals are highly seropositive based on the calculated mean S/P, indicating that vaccination results in a strong serological response. There is no significant decrease in the average S/P ratio from one vintage to another, indicating that vaccination leads to a strong and lasting serological response. All animals with a negative or questionable ELISA result have a negative qPCR result. The 7 animals positive for qPCR are all positive for ELISA, with 1 S/P greater than 150%.	Correlation with other techniques			Vaccination monitoring	
50)Pérez V. *et al*. (2015). **Evaluation of the sensitivity of the ID Screen® Paratuberculosis Indirect ELISA in ovine sera**. Poster presented at the 17th International Symposium of the WAVLD – World Association of Veterinary Laboratory Diagnosticians – Saskatoon, Canada– June 2015.	• The sensitivity of the ID SCREEN® PARATUBERCULOSIS INDIRECT was evaluated on experimentally infected sheep and lambs (using ovine and bovine MAP strains) as well as naturally infected sheep. • *Results*: **seroconversion in sheep appears from 290 dpi, while in lambs its period of occurrence depends on the MAP strain used.**				Experimental infection	Performance evaluation

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51)Köhler H. *et al.* (2015). **Characterization of a caprine model for the subclinical initial phase of *Mycobacterium avium subsp. paratuberculosis* infection**. BMC Veterinary Research 11:74.	• These data report results obtained in 39 goats having undergone artificial infection trials achieved to develop a paratuberculosis pathological model. Map was inoculated with different doses of oral MAP inoculum at different ages. The specific antibody response against MAP was detected using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: **The specific antibody response against MAP started at 14 weeks post-infection in the MAP-inoculated animals**. The proportion of antibody-positive animals, as well as antibody levels, increased until 22–26 weeks post-infection. **S/P% varied largely among individuals** with no significant differences between inoculation groups. No seroconversion was observed in all control animals. **In well-defined infecting conditions, the ID SCREEN® PARATUBERCULOSIS INDIRECT allows showing seroconversion from 14 weeks post-infection.**				Experimental infection	
52)Bergmann A. *et al*. (2015). **In Vivo Volatile Organic Compound Signatures of *Mycobacterium avium subsp. Paratuberculosis***. PLoS ONE 10(4): e0123980.	• Study of Volatile organic Compound signatures of MAP in breath gas and headspace over feces from goats infected experimentally; serum antibody response was measured with the ID SCREEN® PARATUBERCULOSIS INDIRECT. The method of PCA-scatterplots was applied to determine the correlation between VOCs and immunological response. • *Results*: PCA scatterplots reflect the correlations of VOC profiles from feces and MAP-specific antibodies.	Correlation with other techniques				
53)Ahmed I.M. (2010). **Serodiagnosis of Johne's disease by indirect ELISA in ovine**. Iraqi Journal of Veterinary Sciences, Vol. 24, N°1 (41-43).	• JD seroprevalence study in sheep using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: 7/92 (7.6%) samples were positive for antibodies against MAP.			Epidemiological study		
54)Foucras G. *et al*. (2008). **Five-year longitudinal study of serum antibody by absorbed ELISA in an ovine flock endemically infected by *Mycobacterium avium subsp. Paratuberculosis* (MAP)**. Poster and Presentation at World Buiatrics Congress, Budapest,	• The objective of this study is to determine the rate of seroconversion in a single birth cohort of dairy ewes maintained for 5 years in a flock, where paratuberculosis is known to be endemic. Serum samples were screened using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: After a 5 year-survey, cumulative data indicated that the prevalence is 26% in the birth cohort.			Epidemiological study		

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BOVINE AND SMALL RUMINANTS (SERUM)

55)Borujeni M.P. *et al.* (2021). **Comparison of *Mycobacterium avium subsp. paratuberculosis* infection in cattle, sheep and goats in the Khuzestan Province of Iran: Results of a preliminary survey**. Veterinary Medicine and Science, 7(5), 1970-1979.	• Blood samples from 1466 animals including 530 cattle, 568 sheep, and 368 goats were tested using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: The overall apparent and true seroprevalence rate of MAP regardless of animal species was 6.0% and 13.2%. The apparent and true seroprevalence rate of MAP, respectively, was 4.3% and 9.2% in cattle, 6.9% and 15.4% in sheep, 7.1% and 15.9% in goats, respectively.			Epidemiological study		
56)Fawzy, A. *et al.* (2013). **Epidemiological studies on Johne's disease in ruminants and Crohn's disease in humans in Egypt**. International Journal of Veterinary Science and Medecine 1, (79-86).	• Prevalence of MAP antibodies in ruminants using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: The prevalence of MAP antibodies in dairy cattle, buffaloes, sheep, and goats was 46.6% (109/233), 44.8% (26/58), 46.5% (41/88), and 37.5% (21/56), respectively.			Epidemiological study		

OTHER SPECIES

57)Pigoli C. *et al.* (2020). **Paratuberculosis in Captive Scimitar-Horned Oryxes (*Oryx dammah*)**. Animals, 10(11), 1949.	• Paratuberculosis in ten scimitar-horned oryxes (SHOs) hosted in a zoological park was documented by pathology, molecular, cultural, and serological testing (using the ID SCREEN® PARATUBERCULOSIS INDIRECT). Following the death of six of the 10 SHOs, serial investigations of dead and alive animals were performed. • *Results*: MAP-specific antibodies were identified in three of the five dead animals whose serum was available. These results match clinical signs, pathological findings, and PCR results.			Epidemiology study		
58)Salem M. A. *et al.* (2019). **Investigation of *Mycobacterium paratuberculosis* in Arabian dromedary camels (*Camelus dromedarius*).** Veterinary World, 12(2), 218.	• This study aimed to investigate *Mycobacterium paratuberculosis* infection in 30 clinically infected camels using immunological (with the ID SCREEN® PARATUBERCULOSIS INDIRECT), conventional bacteriological, and molecular biological tests. • *Results*: Five MAP isolates were recovered from these investigated camel samples giving an isolation rate of 16.6%, while eight camels were identified by PCR (26.6%). Five camels yielded MAP in their feces by ZN faecal staining (16.6%), whereas ELISA detected anti-MAP antibodies in nine camels (30%).		Correlation with orther techniques	Epidemiology study		

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59)Stanitznig A. *et al*. (2017). **Prevalence of *Mycobacterium avium subspecies paratuberculosis* and hepatitis E in New World camelids in Austria**. Veterinary Record, 181(2), 46-46.	• 443 blood samples from 184 llamas and 261 alpacas were tested using the ID SCREEN® PARATUBERCULOSIS INDIRECT and 399 faecal samples were tested using qPCR and culture for MAP. • *Results*: all 399 animals tested for the shedding of MAP were negative by fecal solid culture. Using qPCR, 15 (3.8%) of the animals were MAP positive and 384 (96.2%) negative. Out of the 443 serum samples examined for specific antibodies, 6 (1.4%) were positive, 1 (0.2%) was questionable and 436 (98.4%) samples were negative.	E Correlation with orther techniques		Epidemiiology study		
60)Meng K.F. *et al.* (2015). **Seroprevalence and risk factors of *Mycobacterium avium subspecies paratuberculosis* infection in domestic sika deer in China**. Trop Anim Health Prod. 47, 999-1003.	• Serologic study on 1400 sika deer in China using the ID SCREEN® PARATUBERCULOSIS INDIRECT. • *Results*: prevalence was 17,6%.			Epidemiiology study		

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