An update on methods for finding TB infection in badger faeces - TB Hub

Background

Following on from several years of Defra funded development of tests for finding TB infection in badger faeces, Defra funded a study[i] in 2015, the purpose of which was to compare the different tests and to determine if any of them, at this stage of development, would be accurate enough to reliably identify infected badger setts.

The comparative study

In the comparative study, test results on faeces collected from badger latrines in an intensively studied location in Gloucestershire were compared with results of both blood tests and culture tests to grow TB bacteria (*Mycobacterium bovis)* from badgers from the same setts. Test results on faeces collected from uninfected, captive badgers were also assessed.

The headline finding from the study is that none of the six tests in the comparative study was sufficiently accurate to allow the Government to consider adopting a new badger control approach based on targeting only setts containing TB-infected badgers.

The Warwick University PCR test performed the best but was not accurate enough to be a practical tool for widespread field use, although it is continuing to be used as a research tool on a small scale in order to further develop the test and its performance.

False positive results (where TB free setts are incorrectly identified as infected with TB) have been shown to be a problem with all the tests included in the comparative study. Even the Warwick University PCR test would be expected **to identify incorrectly a quarter of uninfected setts as infected**[ii]**using a testing programme** based on testing ten samples per sett. The researchers, based on other studies they have carried out, advise testing at least twenty samples per badger sett, which would produce a higher false positive rate (around half of the setts incorrectly identified as positive).

Similarly, false negative results (where infected setts are missed by the test) would diminish the value of these tests for the purposes of targeted interventions – see below.

The Warwick University PCR test – other published work[iii]

Using the Warwick University PCR, testing 20 samples per sett in Gloucestershire during the summer months did identify approximately 80% of infected setts, but 1 in 5 infected setts were still missed. The test was not as good at detecting infected setts at other times of the year. Over the course of a year, testing 20 samples per sett resulted in missing around half the infected setts. Increasing the number of samples is a potential way to overcome these limitations; for example, testing 50 samples per sett during the summer

led to identification of all positive setts in Gloucestershire. However, as described above, testing larger number of samples rapidly results in unacceptably high false positive rates for the test, making practical use very difficult.

Why is it so difficult to develop an accurate test for TB in badger faeces?

TB-infected badger faeces contain intermittent low levels of TB bacteria. This means having to test multiple samples to find evidence of infection. A sett is considered to be TB-infected if one or more sample tests positive. Previous research studies with the Warwick University PCR test showed it required up to fifty samples per sett to find all known TB-infected setts, and the ability of the test to find TB-infected setts varied by season.

Collecting as many as twenty to fifty samples per sett is practically difficult and probably routinely possible only from larger setts. It is more difficult where there is a poorer understanding of locations of setts and associated latrines.

Unlike in Gloucestershire, where detailed monitoring by wildlife experts has been on-going, understanding the relationship between setts and latrines is difficult and badgers sometimes use latrines associated with other setts. The need to collect multiple samples would mean visiting outlying latrines where it is more difficult to establish relationships with specific setts.

Defra position on the existing methods to find TB infection in badger faeces

The Government's current badger control policy is based on scientific evidence from the Randomised Badger Culling Trial and promotes area-based proactive culling of badgers in order to reduce the population densities. Concerns about the 'perturbation theory', where culling only a small proportion of badgers is thought to increase TB transmission from badgers to cattle, support the current policy. The insufficient accuracy of the six tests in the comparative study does not support a change in policy, i.e. to consider adopting a new badger control approach based on targeting only setts containing TB-infected badgers. The Government would need a test that was much more accurate than even the Warwick University PCR test before considering such an approach. Otherwise it could risk making the bovine TB problem worse. Private use of such tests is an option to inform biosecurity management decisions although anyone doing so should bear in mind the reliability of the tests and that Defra will not take official action on the basis of the results.

Defra appreciates that there is an on-going need to understand TB in badgers. In order to gather more information to support future policy development, Defra has commissioned a TB survey in badger carcases found in the Edge Area of England and is also collecting badger carcases in licensed badger control areas for opportunistic surveillance purposes.

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[i] SE3289 – Study to comparatively assess methods to detect M.bovis from badger faeces http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=19296&FromSearch=Y&Publisher=1&SearchText=SE3289&SortString=ProjectCode&S=Asc&

Paging=10#Description

[ii] A sett is considered to be infected if one or more of the samples tested per sett produces a positive result (for example 1 in 10, 20 or 50 samples depending on the testing regime adopted). The Warwick PCR has false positive rate of around 2% – 3% (97-98% specificity) at an individual sample level, equivalent to around 1 in 40 uninfected samples incorrectly testing positive. In this way a very low level of false positives at an individual sample test level quickly leads to a test which results in a high level of false positives at a sett level.

[iii] J Clin Microbiol. 2015 Jul;53(7):2316-23. doi: 10.1128/JCM.00762-15. Epub 2015 Jun 3.

Performance of a Noninvasive Test for Detecting Mycobacterium bovis Shedding in European Badger (Meles meles) Populations. King HC, Murphy A, James P, Travis E, Porter D, Sawyer J, Cork J, Delahay RJ, Gaze W, Courtenay O, Wellington EM. http://www.ncbi.nlm.nih.gov/pubmed/26041891