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Evaluation of the Contribution of Infected Badger Populations to the Prevalence of Bovine Tuberculosis in the Republic of Ireland: Outline of a Field Trial

J. M. Griffin

1. Background and rationale
A number of studies have been carried out on the association between tuberculous badgers and cattle herd breakdowns of tuberculosis in cattle herds in Ireland (O'Connor and O'Malley, 1989). The largest of these studies was carried out in East Offaly (Dolan et al., 1996). A further study comprised of four project areas is being undertaken in other parts of the country to determine what reduction, if any, in the reactor disclosure rate can be achieved in other environments as a result of similar measures. These projects will be designed so as to

(i) give a clear and statistically accurate estimate of the contribution of the tuberculous badger population to the continuing problem of bovine tuberculosis in Ireland, and

(ii) extend the basis for policy formulation for the Bovine Tuberculosis Eradication Programme in general and for the management of the badger population in particular.

An outline of the protocol for the study is described here.

2. Objective of study
The objective of the study is to compare the changes in the number of tuberculin test reactors in the central removal areas following intervention with the changes in the number of tuberculin test reactors in the associated reference areas over the same period.

3. Methodology

3.1 Experimental design

3.1.1 Classification of study design
The study is a field trial in which badgers will be removed from each of four areas. Each central badger removal area is matched with a comparable reference area. The herd and animal incidence of tuberculosis in cattle in the central removal areas will be compared with those in the reference areas over the same time periods.

3.1.2 Selection of study areas
The study areas are located in counties Cork, Donegal, Kilkenny and Monaghan. They were selected on the basis of a number of criteria. These are listed as follows in order of priority:

badgers is attempted for the purposes of the study. It is subdivided into a “central removal area” and a “peripheral removal area” or “buffer area”.

Tuberculin test and badger data from the central removal area will be included in the analysis. Data from the buffer area will not be included in the analysis.

The “reference area” is an area of limited badger removal chosen for comparison purposes. See Section 3.1.5.
• The overall prevalence of tuberculosis during the previous 3-5 years was above the national average.
• In so far as possible, the boundaries consisted of borders such as large rivers, main roads, mountains or bogs that would curb the immigration of badgers from outside of the central removal area.
• Sufficient trained staff were available in the associated District Veterinary Offices to execute the study for its duration.

Detailed geographical information was compiled on each area (Hammond, 1996).

3.1.3 Allocation of experimental units to treatment groups
Each of the removal areas was matched with a reference area using the following guidelines:

• The reactor disclosure rate in the two areas.
• The cattle population, herd size, farm enterprise types and land use in the two areas.
• All herds in both areas were located within the same District Veterinary Office area.

For each matched pair, the area in which badger removal will be undertaken was identified by management staff at the Department of Agriculture and Food, with the advice of the Tuberculosis Investigation Unit. This decision was based on the relative suitability of each area for badger removal. For example, if one of the units of a matched pair had better natural boundaries than the other, that unit was selected as the removal area.

In the East Offaly area there was circumstantial evidence suggesting that some badgers were migrating into the removal area, thus affecting the impact of badger removal. In so far as is possible, the boundaries of the central removal area in the current study consist of natural barriers that will prevent or at least retard inward migration. Such natural barriers may not be available over the full boundary of the central removal areas. In such instances, an effort is made to curb immigration by extending badger removal up to 1 km. beyond the relevant boundary of the removal area proper. Tuberculin test data from cattle herds in those “buffer areas” will not be used in the analysis.

In the East Offaly area, the reference area immediately surrounded the removal area. Thus, the inward migration of badgers may also have affected badger numbers in the reference area. In the current study each reference area is separated from its matched removal area (a) by a boundary (e.g. large river) that reduces the extent of such migration from the reference area or, alternatively, (b) by a distance of at least 3 kms. Precise details of each boundary are described by Hammond (1997).

3.1.4 Determination of the number of badger removal areas
In the Republic of Ireland badgers are a protected species under the 1966 Wildlife Act. Snaring is carried out under licence from the Wildlife Service, Office of Public Works. A decision to undertake snaring in the four areas was made following discussions with the Wildlife Service. Licences were granted based on study design requirements, environmental considerations and the availability of resources within the Department of Tuberculosis Investigation Unit, UCD
Agriculture and Food to undertake the study.

3.1.5 Badger removal policy in the removal and reference areas

The aim in the removal areas is to identify all setts and to remove all badgers present.

In the reference areas, badger removal will be undertaken on and in the vicinity of farms where major outbreaks of tuberculosis occur in cattle herds and where the investigating Veterinary Inspector believes that badgers are likely to be involved. For the purposes of the study, a breakdown will be considered to be “major” if there are four or more standard reactors during the course of a breakdown. The Veterinary Inspector, with assistance from the TIU, will identify the setts to be snared based on the geographical relationship between the herd and the badger setts in the area. The aim will be to remove all social groups that may have had contact with the affected herd. Generally, snaring will be carried out for one year only. However, snaring will be repeated at the setts in the second or third year if the herd owner notifies the District Veterinary Office of badger activity.

3.1.6 Tuberculosis Eradication Programme policy in the reference and removal areas

The Bovine Tuberculosis Eradication Programme in the removal and reference areas will be same as in the programme nationally. The testing regime will consist of one screening test per herd per year. Other tests (e.g. reactor-retests, six-month check tests, etc.) will be undertaken in accordance with the standard guidelines issued by the Department of Agriculture and Food.

3.2 Organisation of field work

3.2.1 Demarcation of areas and identification of herds within each removal/reference area

The boundaries of the eight study areas have been demarcated using the guidelines outlined above. A herd register will be obtained for all farms in each of the study areas. This will be compiled from the District Veterinary Office herd registers. The Department of Agriculture and Food is presently compiling a database of digitised maps of all farms that are included in EU area aid packages. This database contains details of field outlines plus a unique identification of each land parcel. It will be used to identify farm locations and boundaries in the study areas.

3.2.2 Identification of badger setts

At the start of the study, a survey to identify all badger setts will be carried out in both the removal and reference areas. The purpose of this will be to locate as many setts as possible. A number of sett features including sett location, number of holes and the number of active holes will be recorded on a specially designed form (Appendix 1).

3.2.3 Survey

The survey team will be divided into pairs of surveyors. In so far as possible each pair will consist of a trained Agricultural Officer and a member of the Farm Relief Service. Each team will be allocated a particular geographical area by the Area SAO. They will be supplied with a six inch map, an aerial photograph of the survey area and a field notebook. Each photograph, covering an area of 2 kms. by 1.5 kms, will have a unique 5 digit number. The surveyors will systematically survey the area allocated to them. Both sides of every ditch will be walked as well
as the perimeter of plantations/wooded areas. The location of all setts that are identified will be recorded on the aerial photograph. Each sett will be given a unique number by the surveyor.

3.2.4 Badger snaring

Formal snaring in the removal areas will begin on September 1st, 1997. All badger carcases will be sent to a veterinary laboratory for post-mortem examination. Pooled lymph nodes will be taken from each carcase and subjected to culturing for \textit{Mycobacterium bovis}. It is intended that snaring of most of the active setts in the Central Removal and Buffer areas will be undertaken over a 16 week period. Subsequently, each sett will be visited twice yearly. Snaring will be carried out if there is evidence of activity.

A pre-designed form will be completed by the field operator in relation to each badger snared or killed by a vehicle on the road (Appendix 2). The partially completed form will accompany the badger carcase to the laboratory in an envelope attached to the outside of the bag. At the laboratory the post-mortem results and other data will be added to the form. The reports will then be sent to the Tuberculosis Investigation Unit where the information will be compiled for analysis.

Data analysis

Data analysis will be undertaken with the assistance of the Department of Statistics, University College Dublin and the Department of Population Medicine, University of Guelph.

4. References


Appendix 1

SETT RECORD

DVO Herd No. Date of visit

Sett Identifier

PHOTO NO. NO.

LOCATION: Please indicate the sett habitat - N = No Y = Yes

Hedgerow River banks Urban
Woodland Roadside verges Edge of bog
Pasture Railway banks Scrub
Farmyard Ringfort Other (Please specify)

Please give brief description if the above categories are not suitable


Could cattle access the sett entrances? N = No Y = Yes

If not, please give details


OPENINGS / ACTIVITY

Total no. of openings: No. being used: No. with spoil heaps:

Approximate distance between the two most distant openings


SIGNS OF OCCUPATION N = No Y = Yes

Paths Latrines Hairs Bedding Rooting/Hoking Other (specify)


ILLEGAL INTERFERENCE N = No Y = Yes

If Yes please specify


IN YOUR OPINION IS THIS A MAIN SETT? N = No Y = Yes

Recorder: _______________

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Appendix 2. POST-MORTEM EXAMINATION DETAILS OF BADGERS

District Veterinary Office
Tag number

Origin: 1 (snared), 2 (casualty)
Herd owner (if known)

If snared
Associated Licence Number
Sett number

If road traffic casualty;
Map No.
X coord
Y coord

Signature of Recovering Officer
Date acquired

TO BE COMPLETED AT THE LABORATORY

Laboratory
AB = Abbotstown, AT = Athlone
CK = Cork, KK = Kilkenny, LM = Limerick, SL = Sligo, EC = Equine Centre

Reference no.
Date received

Sex
M = male, F = female

Weight
Kgs.

Age
C = Cub, Y = Yearling, A = Adult

Result of post-mortem examination

<table>
<thead>
<tr>
<th>REGION</th>
<th>TISSUE EXAMINED</th>
<th>GROSS (VL/NVL/O)</th>
<th>HIST. (+/-/O)</th>
<th>CULT. (+/-/O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARCASS</td>
<td>Skin (Bite wounds)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prescapular l.n.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Popliteal l.n.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEAD/NECK</td>
<td>Phary. or Par. or Subman. l.n.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABDOMINAL CAVITY</td>
<td>Kidney</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spleen</td>
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<td></td>
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<tr>
<td></td>
<td>Hepatic l.n.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Mesenteric l.n.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Liver</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>THORACIC CAVITY</td>
<td>Lung tissue</td>
<td></td>
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<tr>
<td></td>
<td>Mediastinal l.n. or Bronchial l.n.</td>
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Comments

Signature of Veterinarian who undertook gross examination

ERAD/TEAGASC
Tuberculosis Investigation Unit, UCD