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COST Action FA0803

COLOSS

Work Shop

Modelling and Standardization

(Chapter 12 BEE BOOK)

Tersoal, January 9-11, 2012

Local Organizer

Netherlands Centre for Bee Research: Romée Van der Zee
Workshop Administration: Lennard Pisa

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Workshop Program

COLOSS Work Shop

Bee Book Chapter 12; Modelling Approach

When: 9-11.01.2012

Where: Nederlands Centrum Bijenonderzoek,
Durk Dijkstrastr. 10, 9014 cc Tersoal, Netherlands
tel: 0031 515521107/003106 38899852

Agenda

TIME	PROGRAM
9.01.2012 (Monday) – NCB Tersoal	
Arrival and informal social gathering in the evening	
17:00 – 19:00	First Presentations Analysis 2010-2011 International Data Set
10.01.2012 (Tuesday) – NCB Tersoal	
09:00 – 10:30	Presentations continued
10:30 -10:50	Coffee break
10:50 - 12:30	Discussion about the modelling approach
12:30 – 13:30	Lunch
13:30 – 15:00	Discussion about the modelling approach
15:00 – 15:30	Energy break
15:30 – 18:00	Standardizing the modelling approach
20:00 – open	Social dinner
11.01.2012 (Wednesday) – NCB Tersoal	
09:00 – 10:30	Development Essential Questions on Colony Losses
10:30 – 10:50	Coffee break
10:50 - 12.30	Development Optional Questions on Colony Losses
12:30 – 13:30	Lunch
13:30– 16:00	Preparation Bee Book Workshop York

Austrian Approach to identify Risk Factors of Colony Losses

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In Austria we have now monitored overwinter colony losses since 2007/2008. The nation wide losses so far ranged from 9.3% to 16.4% and can therefore be regarded as moderate, compared to other countries. In 2010/2011 response was 565 questionnaires in our mixed media survey (meetings, journal, internet). Nonetheless, single operations or whole regions experienced higher losses. For example, the region of Tyrol experienced high losses (24.7 and 25.4%, n=76-88) during two winters in row. The drivers of these elevated losses have not been identified yet. Conventional statistics (comparison of subgroups) did not reveal main reasons causing colony losses. This demonstrates that more combined efforts (with higher sample size) are necessary to identify risk factors. Last years' COLOSS questionnaire allows to evaluate the impact of factors like hive management, e.g. treatment against *Varroa sp*, on a larger scale. Therefore, modelling risk factors using a dataset including several contributing countries will hopefully reveal more insights in colony losses.

Alison Gray: Analysis and Modelling of the COLOSS International Data Set 2010-2011

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Colony Losses have been calculated for Netherlands, Germany, Poland, Hungary, Austria, Denmark, Ireland and the UK. The following approach was used.

Initial analysis was conducted using examination of the data and descriptive statistics. Some inconsistencies in the data were found, for further consideration. Using appropriate selection of cases, colony losses were calculated for the countries above individually and also overall, using overall proportion of loss, CDS type loss and loss due to queen problems, and also the mean/median of the individual loss rates per beekeeper. The proportions of beekeepers suffering any loss of any kind were also calculated. We both included and excluded Scotland as part of the UK. Differences between countries were found based on 95% confidence intervals for proportion of losses.

Some suggestions are made in relation to data quality control and data modelling. Logistic regression/binomial-logit generalised linear modelling may be used to model the chance of any loss, any CDS loss, or loss due to queen problems.

Model Approach International Data Set 2010-2011

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Colony Losses have been calculated for Netherlands, Germany, Poland, Hungary, Austria, Denmark, Ireland and the UK. We took the following approach :

*Calculate exposed amount of colonies for each operation:
Nb of colonies in October 2010 – Solded colonies – Merged colonies + Splited colonies
*Loss are Colonies in April 2011- Exposed Colonies
*Loss rate is: Lost colonies/Exposed colonies*100

Average loss rate for those 8 countries is 20%

We also studied impact of some factors on the loss rate

Van der Zee and Pisa; Development of a binomial model to estimate colony losses and identify risk factor

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Elementary analysis of the answers to the essential questions, regarding colony losses, can yield an estimate of the overall loss rate for the observations (beekeepers or operations) grouped together by a single factor (such as country, or involvement (or not) in commercial pollination). Comparing these loss rate estimates and confidence intervals for the loss rates can indicate differences between the groups and hence potential risk factors relating to the risk of colony loss. The overall loss rate is a problematic estimator when the contribution of multiple factors to the risk of loss has to be determined, since factor responses may be associated, not independent of each other. For example, commercial pollination is more common in certain countries than others. Larger scale beekeepers contribute more to the overall loss rate than smaller scale beekeepers.

A statistical approach that deals with the difficulties of overall loss rate and enables conclusions on how factors (bee race, pollination practices, size of operation, honey yield, location etc.) influence colony losses is regression analysis. In regression analysis, the numerical outcome of the essential questions (number of colonies lost, number of colonies alive or the calculated population at risk) is linked to the factors through a linear model. In the analysis of bee colony losses, many of the response variables of interest are positively skewed (having a long tail to the right) and so generalized linear regression models (GZLMs) are appropriate. These models assume that the observations y_i arise independently from a specified family of probability distributions, and independent variables or factors $x_{j,i}$, $j=1,\ldots, k$, are used to provide a set of linear predictors

$$\eta_i = \beta_0 + \beta_1 x_{1,i} + \cdots + \beta_k x_{k,i}$$

such that $g(\mu_i) = \boldsymbol{\eta}_i$, where μ_i is the mean of y_i, and the β_i are model coefficients to be estimated. Using GZLMs requires the specification of an appropriate probability distribution for the response variable y and also an appropriate form for the link function g (Krzanowski, 1998; Nelder and McCullagh, 1989).

The dependent variable of interest, the loss rate, is binary in the nature of its components (the number of dead colonies divided by the number of colonies at risk makes up the loss rate). This property leads to models that use a binomial distribution for the dependent variable. During workshop a binomial model will be illustrated using the Dutch Data set.

List of Participants

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