In partnership with

CSI POLLEN PROJECT WORKSHOP

Proceedings

Glasgow, Scotland, 1ST-2ND FEBRUARY 2016

CSI Pollen Project Workshop

Topic

- Results, data analysis and the continuing project

When

- Monday 1st and Tuesday 2nd February 2016

Where

- University of Strathclyde, Glasgow, Scotland, UK

Schedule

SUNDAY 31st JANUARY 2016

Time	Pre-workshop
18.15-	Optional welcome gathering in the foyer of the Premier Inn (187 George Street, Glasgow, G1 1YU), to meet Magnus Peterson and Mr Rob McGowan, representing Scottish beekeepers, followed by dinner at about 19.15pm at Café Andaluz (12-15 St Vincent Place, Glasgow, G1 2DW).

MONDAY 1st FEBRUARY 2016

Time	Session 1 – Registration
8.30-9.00	Registration/socialising in Department of Mathematics and Statistics, room LT9.11, Livingstone Tower, 26 Richmond Street, Glasgow G1 1XH

MONDAY 1st FEBRUARY 2016

Time	Session 2 – Welcome, overview and working groups
9.00-9.05	Welcome from local organisers (Alison Gray, Magnus Peterson) in room LT9.07
9.05-9.15	Welcome from Head of Department (Professor Iain Stewart) in room LT9.07
9.15-9.30	Presentation (Robert Brodschneider, Sjef van der Steen): review of CSI Pollen and plan for the workshop, confirmation of working groups, in LT9.07
9.30-11.00	Working groups in LT9.07/LT9.08 (throughout the workshop) Group 1: Paper drafting Group 2: Data analysis
11.00-11.30	Coffee/tea/discussion break in LT9.11
Session 3 – Progress update and working groups	
11.30-11.45	Brief updates from group spokespersons, in LT9.07
11.45-13.00	Working groups in LT9.07/LT9.08 Group 1: Paper drafting Group 2: Data analysis
13.00-14.00	Lunch in LT9.11
Session 4 – Working groups	
14.00-15.45	Working groups in LT9.07/LT9.08 Group 1: Paper drafting Group 2: Data analysis
15.45-16.15	Coffee/tea/discussion break in LT9.11
Session 5 – Review and close of day	
16.15-17.00	Review and updates from groups in LT9.07
17.00	Close of day 1 (Robert Brodschneider, Sjef van der Steen, local organisers) in LT9.07
18.15-	Social dinner : Meeting at the Premier Inn (187 George Street, Glasgow, G1 1YU), then for social dinner at Qua (68 Ingram Street, Glasgow, G1 1EX).

TUESDAY 2nd FEBRUARY 2016

Time	Session 1 – Presentation, discussion and working groups
9.00-9.05	Introduction to day 2 (Robert Brodschneider, Sjef van der Steen) in LT9.07
9.05-9.30	Presentation, Janko Božič : Comb orientation toward the exit of the hive affects diversity of the collected pollen in LT9.07 (10 mins plus questions/discussion)
9.30-10.30	General discussion on side-projects and continuation of CSI Pollen
10.30-11.00	Working groups in LT9.07/LT9.08 Group 1: Paper drafting Group 2: Data analysis
11.00-11.30	Coffee/tea/discussion break in LT9.11
Session 2 – Working groups	
11.30-13.00	Working groups in LT9.07/LT9.08 Group 1: Paper drafting Group 2: Data analysis
13.00-14.00	Lunch in LT9.11
Session 3 – Progress updates and working groups	
14.00-14.30	Updates from group spokespersons, in LT9.07
14.30-15.30	Working groups in LT9.07/LT9.08 Group 1: Paper drafting Group 2: Data analysis
15.30-15.45	Coffee/tea/discussion break in LT9.11
Session 4 – Working groups, review and close of workshop	
15.45-16.50	Working groups in LT9.07/LT9.08 Group 1: Paper drafting Group 2: Data analysis
16.50-17.00	Review and Close of workshop (Robert Brodschneider, Sjef van der Steen, local organisers) in LT9.07
18.30-	Meeting at the Premier Inn (187 George Street, Glasgow, G1 1YU), followed by dinner at Wagamama (97-103 W George St, Glasgow G2 1PB) at 7pm, together with arrivals for the COLOSS Monitoring workshop.

ORGANISER CONTACTS	
Alison Gray (main organiser and editor of these proceedings)	**Magnus Peterson**
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Abstract

Overview of two years C.S.I. Pollen

Robert Brodschneider[1], Elfriede Kalcher-Sommersguter[2] and Jozef van der Steen[3]

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The C.S.I. Pollen Project is aiming at investigating the pollen diversity available to honey bees by counting the number of colours found in pollen samples by beekeepers engaging as citizen scientists. The first two years of the project with nine samplings each year are now completed. 165 citizen scientists participated in our study in the year 2014 only, 285 in the year 2015 only, and 300 participated in both study years. These add up to a total of 465 participants in 2014 and a total of 585 participants in 2015 from 24 and 27 countries of the northern hemisphere, respectively. We received a total of results from 8094 samplings in 2014 and a total of 9823 samplings in 2015. 69 percent of the collected samples met the required amount for standardized analysis of 20 gram pollen in 2014 and 65 percent in 2015. The mean number of samples that reached the required amount of pollen per sampling period was 623 in 2014 and 705 in 2015. During the workshop the data will be analysed, i.e. we will run statistical models to evaluate possible effects of habitat and season on pollen diversity as indicated by the number of colours found in the collected pollen samples. During the workshop the database will be further analysed and discussed in detail. Simultaneously we will start writing a report to end this phase of the CSI pollen project. The project might continue in a smaller group, for which new responsible persons will need to be found, but interest and ideas for continuation of this project have been raised.

Abstract

Comb orientation toward the exit of the hive affect diversity of the collected pollen

Janko Božič[1] and Miha Štular[2]

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Beekeepers most often use hives in which combs are directed parallel to flight direction outside of the hive. This type of set-up is called cold construction, because the air from the outside can reach all the frames at the same time. In this case foragers are dispersed onto most of the frames when they arrive into the hive. The rectangular set-up of frames is warm construction where most of the foragers climb on the first frame, closest to the hive exit. Beekeepers main concern was how such set-up could affect thermo-regulation inside of the hive. But there could be another effect of such set-up. We put hypothesis that in case of warm construction bees from all different foraging patches could communicate through waggle dance more frequently different patches then in case of cold set-up when dancing bees are spread over several combs. That could result in diversity of the collected pollen. We used pollen collectors and simple sorting of pollen loads on color base. Preliminary study with 10 different colonies of different strength divided in two groups didn't give any potential results. In this case diversity can be better related just to the strength of the colonies. Next experiments were carefully prepared with 4 colonies of equal strength and with sister queens. In the second experiments there were selected two colonies in cold set-up and two in warm set-up. During five sampling dates it was always higher number of different colors in cold set-up then in warm set-up. In the third experiment we also exchanged roll of hives during the experiment. We observed twice on five sampling dates and in all 10 sampling days cold set-up had higher number of colors then warm set-up. There was also indication that bees collected more pollen in warm set-up, but less diverse then in cold set-up. We concluded that observed difference are in agreement with postulated hypothesis of different rate of comparison between foraging patches through dance communication in warm and cold set-up of frames.

Abstract

CSI Pollen in Ireland

Mary F. Coffey

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During 2015, as a result of financial assistance from both the C.B. Dennis British Beekeepers Research Trust and the Federation of Irish Beekeepers, a total of 30 beekeepers distributed throughout Ireland actively participated in the survey. However, as the season progressed from April to September, the total number of beekeepers collecting pollen from all three colonies decreased from 26 to 10 respectively. Reasons given for this decreased participation by beekeepers included poor weather in July/August and subsequently the risk of pollen deprivation in the colony, queenlessness and swarming. The total mean number of pollen colours identifed increased from 4 in April to a maximum of 8 in July, but the number of pollen colours in individual samples was much higher, reaching a maximum of 15 in one sample in June. Throughout the season >70% of samples analysed has 1 or more abundant pollen types, while very rare pollen types were only identified in approximately 40% of samples. Thus, sorting pollen by colour gives an indication of the diversity of pollen available to honeybees; however Irish beekeepers generally feel that knowledge of the floral origin would enhance the data already accumulated and thus the aim is to carry out pollen analysis on at least some of the samples. However, how this will be achieved is still under discussion.

Abstract

Diversity of pollen sources: Preliminary data from CSI Pollen 2015 in Spain

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The coordination of CSI Pollen in Spain has achieved a relatively satisfactory answer, with several partners from different locations and beekeepers with apiaries placed in different habitat types, climatic zones and diverse vegetation. There are about 22 beekeepers whose answers and samples are received in a continuous and regular way. Close to 325 samples are collected; their pollen spectra and protein content were analysed in our laboratory. Small differences were observed in foraging among the three colonies from each hive. Due to the uneven climatology we are experiencing this year in the Iberian Peninsula, some beekeepers, under unfavourable weather, have chosen the option of varying the sampling date according to weather variations. Preliminary results have shown: 1. variability in protein content, 2. diversity and availability of pollen sources throughout the year, 3. forage variability between colonies of the same apiary. Once the total amount of samples are analysed, data related to protein content variability within the same types of pollen, as well as geographical and temporal influence on this composition will be obtained. Continuity of the project is expected since important factors such as climatology and tracing of the apiaries development will provide valuable information.

Abstract

Experience of CSI Pollen in the UK

Alison Gray[1], Magnus Peterson[2], Norman Carreck[3], Mary F Coffey[4]

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England and Wales, Scotland, and Ireland/Northern Ireland have all participated in CSI Pollen. The project has been promoted through the beekeeping association magazines, websites, meetings and email lists. England and Wales and Scotland began the project in 2014, while the Irish national co-ordinator participated in 2014 before recruiting beekeepers across Ireland and N. Ireland to take part in 2015 (reported on separately). Generous funding by The C.B. Dennis British Beekeepers' Research Trust allowed greatly increased beekeeper participation in 2015. We plan to continue in 2016, to allow beekeepers using the extra pollen traps acquired in 2015 to collect pollen data for a second year, as well as to enable volunteers in Ireland/N. Ireland to collect data over two years.

In 2015 a total of 69 participants from England and Wales collected regular samples, up from 24 in 2014, thanks to the funding received. A few other beekeepers participated but for various reasons were unable to complete the year. The weather in most areas was kinder than the previous year, when many samples could not be collected due to rain for the entire sampling "window".

In Scotland SASA (Science and Advice for Scottish Agriculture) supplied most of the pollen traps used in 2014, and we are grateful for the continued use of these. From 11 beekeepers regularly participating in 2014, the number of participants was increased to 29 in 2015. However poor weather in spring/summer 2015 greatly limited opportunities for pollen collection. A few beekeepers felt that using pollen traps was detrimental to their bees who were struggling anyway, or collecting pollen was not possible, and either did not collect pollen or decided to withdraw from the project. We plan to recruit further participants to maintain numbers as far as possible for 2016.

For level 2 analysis, samples from England and Wales and Scotland were sent to Turkey for lab analysis and representative results are awaited. For 2015, level 2 analysis in Ireland will be addressed via workshops for interested CSI volunteers, run by the national co-ordinator. A total of 15 participants from across Scotland have sent 228 pollen samples to us for possible level 2 analysis. Participants in England and Wales have been encouraged to freeze and retain their pollen samples, and we believe that most have done so. After considering possibilities, in Scotland a network has been established of CSI volunteers with at least some microscopy experience, willing to learn about palynological analysis and we propose to set up a series of meetings to take this forward. Ideally some of the results of the samples analysed by this network would be confirmed by a professional palynologist, however the plan has the advantage of allowing more analysis than would otherwise be possible, as well as engaging some of the CSI volunteers in analysing their own samples for direct feedback on pollen sources accessed by their bees.

Abstract

CSI pollen project in Greece- overview

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In Greece, CSI Pollen project started in 2013, when only 3 people participated and they send their pollen samples to our laboratory for pellet-colour separation and data recording. The higher diversity in pollen colours was observed in April and May, with a peak in late April. For 2014, nine partners recorded the colours of pollen they were collected from 3 colonies at each time point and they submitted in online. In general higher numbers of colours were recorded in 2014 than 2013. Higher diversity was observed during April. For 2015, only 5 partners participated. Data for 2013 and 2014 showing the average values for the whole country as well as for each sampling area and time point was published in the local beekeeping journal (in Greek). Naturally the information of each area is important for the region itself and not to the others, but on the whole give a good picture of the availability of pollen. Participation of beekeepers in the course of the project showed what such a collaboration can achieve.

Abstract

CSI Pollen in Romania

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Bee pollen, an agglomeration of pollen grains collected by the honey bees from various botanical sources, represents the best protein source for bee colonies. Although the chemical composition of bee pollen is complex, many studies showed that a single variety of pollen does not meet all the nutritional needs of bee colonies. In terms of pollen, plant species differ in terms of quantity and quality of their produced pollen.

During two years of CSI study (2014 and 2015), a number of 41 beekeepers have submitted data regarding pollen gathering from various regions of Romania, of which 30 beekeepers have submitted at least one result, and 11 beekeepers have submitted their results regularly. The bee colonies from Romania seems to have a pollen diets well-rounded, in terms of diversity and abundance. The rainbow of pollen colors (orange, yellow, red, white, green etc) was present during the two years of study, but the same study showed that pollen colors change depending on season and region. The maximum pollen color diversity was reached during mid-May until mid-June, while the poorest diversity period was set by August end, these findings being confirmed during the two years of study.

Abstract

Some results of 5 years pollen collection in Denmark

Asger Søgaard Jørgensen

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From 2011 to 2016 we have collected pollen samples from bee colonies distributed all over Denmark. The last 2 years the samples was from the participants in the CSI-pollen project. Results of the sampling and the analyses will be presented.

Abstract

CSI Pollen in France in 2015

Jean-François Odoux and Mélanie Chabirand

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CSI Pollen France involved 75 apiaries in 2015 thanks to beekeepers as well as some beekeeping associations and schools. Nine times a year, they all together collected samples of pollen at the entrance of their hives and counted the colours number to assess the diversity of the pollen diet. Most of them offered several habitats to their honeybees but the major landscapes were crops, village and grasslands. The sampling duration lasted almost 2 days in average for each sampling and we verified that counted colours number was not correlated with the participant assiduity efforts. In spite of different weather conditions, the French volunteers confirmed the results obtained in 2014, namely the highest diversity was encountered at the beginning of June and the lowest values at the end of September. Abundant colours were maximum in spring as well as very rare colours. The latter were present as soon as the beginning of the season but were higher at mid-May, suggesting that pollen resources become scarce. Colonies collected less diversity that the whole apiary so that the annual average of colours is 5.64 per hive and 6.92 per apiary and the difference was higher in April. One of the colours was higher than 50% almost one in two times. Total results for 2014-2015 involved 91 apiaries and showed a larger participation in Poitou-Charentes, Ile-de-France, Bretagne and Aquitaine regions. The first two showed a highest pollen colours number and Bretagne a lower level. Urbanised located apiaries provided heterogeneous data. The pollen diversity along the season seemed to better distributed in some regions. CSI Pollen France was promoted in France in 2 beekeeping magazines in 2015.

Workshop Summary

The workshop was organised to

1. finalise data analysis of the 2014 and 2015 study, to start writing the paper of the results of the 2 years of this CSI project on pollen diversity based on pollen colour diversity
2. discuss the continuation of the Task Force.

2014 – 2015 study

To achieve these objectives, after the opening session the participants were split up into a data analysis group and a writing group. Both after the morning and afternoon plenary sessions were planned to evaluate the results. In the opening Robert Brodschneider and Sjef van der Steen announced that they both resign as chairs of this part of the CSI pollen project after completion of the analyses and paper. The CSI pollen project will continue (see 2) via side projects and for a 3rd year of pollen collection in some countries.

The workshop time was dedicated to the activities mentioned above apart from the interesting presentation of Janko Božič about the possible impact of "warm" and "cold" hive construction on the information flow and hence the diversity of pollen collected by bees. Finally there was discussion as to which journal the paper of the 2014- 2015 results should be submitted. The current aim is to go for a journal that might have a special library for articles related to CS initiatives. One such journal might be PLOS One. This option could be the alternative to JAR where most of the COLOSS output articles have been submitted and published. No decision was taken, although there was a long discussion, as we need to search further for the pros and cons of both options. A strong point in the discussion was that we wish to have this article as open access (for JAR we need to pay, for PLOS One we need to pay as well and make the data available).

All national coordinators will be asked to be co-authors and to send their affiliations. They will also decide which active members of their team could also be included in the authors' list. Robert Brodschneider will be the first author and Jozef (Sjef) van der Steen the last one. Others would be in alphabetical order.

Acknowledgments should be given to all national projects as well as COLOSS and the funders. The costs of open access will be shared among the co-authors.

Data analysis group. (Alison Gray, Elfie Kalcher-Sommersguter, Janko Božič, Jean-Francois Odoux, Nicoleta Ion, Magnus Peterson)

Hard work has been done to evaluate this huge database. Descriptive analysis and some model fitting were carried out after formatting the data suitably in different files and conferring with the paper writing group. Many participating beekeepers in about half of Europe could not submit data in April 2015 because of the bad weather conditions. The beekeeper's ID had a stronger effect on the numbers of colours than the colony or the country. So it is suggested only to analyse the complete European dataset, not only countries. A strong effect of the beekeeper could be expected as normal for citizen science.

The first overall results indicated a median number of abundant colours throughout the season of about 4, and some first graphs and tables were provided. Model fitting required some exploration of the data structure. The results of the relation of the number of pollen colours (total number per colony, number of abundant/rare/very rare colours) to longitude, latitude, altitude and land-use were not complete at the end of the 2-day workshop. The plan was to fit different models for 2014 and 2015 and a combined model. Effort focused on 2014, and finding the optimal random effects structure before using model selection. It was agreed that further work would be carried out over the next few weeks to complete the analysis. Description of methods and interpretation of results would also be provided.

Scientific paper writing. (Fani Hatjina, Asger S. Jørgensen, Norman Carreck, Amelia González-Porto, Antonio López-Pérez, Robert Brodschneider, Sjef van der Steen, Dirk de Graaf). Writing a paper with colleagues appeared to be fruitful. Starting with what Robert Brodschneider had already drafted, the introduction, materials and methods were largely completed except for the statistical methods that will be included, and the results and discussion were started. References were also compiled. The identical results of 2014 and 2015 from the overall data from the 23 participating countries and the 8094 (2014) and 9823 (2015) data points of 465 (2014) and 585 (2015) participants, including 300 participants that contributed both in 2014 and 2015, about diversity of colours indicate that independent of the land uses, the honeybee colony's foraging strategy determines the diversity (assuming there is something to choose).

Certain details were assigned to participants to provide more information / references.
Some discussion took place also about the accuracy of the measurements taken by the CS. For this reason, the same pollen samples from Austria as well as from Greece will be given to several people, in order to determine their efficiency and accuracy in a small experiment.
Finally, a proposal for a popular article after this publication was accepted, in order to be translated in different languages for local journals. There is an immediate need for popular articles for those countries continuing and for the countries that have completed the submission of the data, to keep the current participants and the participants who have completed their efforts informed.
On 14 March 2016 Robert and Sjef will spend a day to complete the paper. Hopefully Dirk can join this.
Several working titles for the article were already being suggested, but no decision was taken.

Plenary sessions

- Continuation of CSI Pollen
  - Alison Gray will take over the organisation and co-ordination of sampling and the CSI database.
  - Pollen collection (as in 2014 – 2015), in order to build up a further year's record will go on in England, Wales, Scotland, Ireland, Belgium, France and Denmark and possibly also in Latvia, Serbia and the Czech Republic.
  - Robert Brodschneider and Elfriede Kalcher-Sommersguter have made available web material and LimeSurvey software for Alison Gray and Magnus Peterson to host on the University of Strathclyde server.
- Level 2 papers
  - Austria and Denmark have completed level 2 analysis. Italy, the Netherlands, England, Wales and Scotland have sent samples to Asli Ozkirim for level 2 analysis. France had also sent samples to Asli as well as some to Amelia González-Porto in Spain.
  - It was agreed to write individual papers for each country. A paper on Britain and Ireland will follow after 2016. Perhaps a joint paper could be written later.
- Further level 2 analysis
  - Various possibilities have been investigated. Asli has offered to analyse samples but it is uncertain how many samples per country she is able to do.
    - Norman will contact Asli about this.
  - Amelia González-Porto is interested in mixed pollen pellets to investigate where, when and why they are mixed. Robert Brodschneider proposed to collect these samples anyway in cases where they were identified by the beekeeper.
  - Viruses
    - Dirk de Graaf has done a pilot study with samples provided by Robert Brodschneider and identified various viruses. The relevance of how meaningful these results are was discussed.
    - It was agreed that in principle national coordinators can provide Dirk de Graaf with samples if Dirk can find a suitable student and funding.
  - Pesticides
    - There was much discussion about this subject. It is certain that pesticides will be found in pollen samples. However there are concerns about storage / contamination problems, costs of analysis and choice of which compounds to test for, and last but not least the interpretation of the results
    - It was agreed that whilst in principle samples could be provided, this would not be pursued at present. Simone Tosi had sent a message that this part could not be funded in Italy.
  - GIS analysis
    - Antoine Lecocq in Denmark is interested in using land-use maps in conjunction with the data set. As already agreed in Copenhagen in the 2015 workshop, we will cooperate.
- CSI Pollen is essentially a bee-nutrient group, and new proposals about relations of nutrients / honeybee colony health are welcome. It was agreed that the CSI Pollen network is a continuing source of intelligence for COLOSS on these matters.

Participants

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