COLOSS – varroa control taskforce workshop: assessment of alternative methods for varroa control, 19-20 May 2016, Unije, Croatia

Michelle Taylor

June 2016
Report for:
Apiculture New Zealand Research Focus Group Honey Trust; Bells Honey; Trees & Bees Ltd
Barry Foster

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EXECUTIVE SUMMARY

COLOSS – varroa control taskforce workshop: assessment of alternative methods for varroa control, 19-20 May 2016, Unije, Croatia

Michelle Taylor
Plant & Food Research Ruakura
June 2016

COLOSS

COLOSS consists of about 80 members from around the world that conduct research with the aim to prevent honey bee COlony LOSSes. Research trials are conducted according to their interest in the five taskforces:

1. Varroa control (the workshop being reported on)
2. Honeybee breeding
3. Vesper (wasps)
4. Monitoring
5. BRAP – Bridging of research and practice

Each taskforce meets at least annually to report on research trials, discuss changing research focuses, set priorities and plan for future collaborative research. Within each taskforce, the goals are realised within working groups (WG) that are led by coordinators. These WG are activated and retired as required.

The 2016 workshop of taskforce 1 was held in Unije, Croatia, from 19 to 20 May 2016. The working groups for taskforce 1 are:

Working Group 1: Infestation assessments
Compare methods to assess varroa infestation levels: Soap, alcohol, icing sugar and natural mite fall (NMF).

Working Group 2: Brood interruption
Compare management techniques to control varroa using oxalic acid or formic acid treatments associated with honey bee brood interruption.

Working Group 3: Currently inactive

Working Group 4: Formic acid management
Identify intra-colony and environmental parameters to increase formic acid (FA) efficacy and produce base-line data.
Working Group 5: New treatment assessments

Newly established working group to be led by Maja Smođis Skerl, Slovenia. Could be used to test efficacy of new varroa treatment products.

Working Group 6: Varroa control protocols

Newly established working group to be led by Flemming Vejsnaes (Denmark) and Victoria Soroker (Israel). Join with BRAP to take the information to beekeepers.

Varroa survivor breeding programme

Unije was selected for the workshop as it is the location of the collaborative Varroa-survivor honeybee breeding programme between Italy, Germany (Stefan Berg) and Croatia (Nikola Kezic). The programme was established 17 years ago to select for colonies that survived varroa without treatment. The longest surviving colony, hive 109, survived for seven years although the colony in the latter years was not in any condition to collect a sizeable honey harvest. Other colonies have survived for a couple of years but have since died out. The survivor-colony programme continues on Unije with continued colony introductions for survivor-testing.

A varroa-survivor breeding programme is not a recommended option for New Zealand beekeeping as open-mating means that progress would be slow. Breeding for varroa control traits in New Zealand, such as the Varroa Sensitive Hygiene (VSH) breeding programme that was previously conducted in New Zealand by Plant & Food Research (PFR) for the National Beekeepers Association, could be an important component of an integrated control programme if a genetic test for VSH could be validated.

Oral presentations were conducted by seven research organisations including PFR. General discussions around this research were conducted within the working groups.

2016 COLOSS questionnaire on honey bee colony losses

COLLOSS conducts an annual colony loss questionnaire containing 23 questions to collate information from European countries about factors that may be influencing colony loss. The data is compared across countries and trends are highlighted. The results are published annually and New Zealand is welcome to survey honey bee colony losses using the COLOSS questionnaire and be included in the COLOSS press release.

In general, European beekeepers are experiencing varroa resistance to synthetic pyrethroids such as fluvalinate, flumethrin, amitraz and coumaphos. However, most countries still appear to have one chemical that is more effective than others so most beekeepers still use one treatment per year of flumethrin, amitraz or coumaphos in conjunction with oxalic acid. German and Danish beekeepers also utilise a weather website to predict best application times for organic treatments.

*No*sema ceranae* is thought to cause delayed colony development in spring / summer in some European countries.
The majority of the European beekeeping industries are hobbyist so the scale is completely different to New Zealand, but the take-home messages were:

1. Use the synthetics in conjunction with oxalic acid, but expect colony losses of around 10%.

2. PFR’s research on organic acids under New Zealand conditions needs to be published in academic journals, not just the MPI website, as COLOSS is starting to assess what we identified 10 years ago.
   - Formic acid trials showed the efficacy varied between 50 and 90%. This supports New Zealand research.
   - Oxalic acid efficacy is also variable.

3. Planned research relevant to New Zealand by the working groups includes:
   - Identifying the effect of brood interruption on varroa control when used in conjunction with oxalic acid.

Efficacy of proprietary formic acid products upcoming conferences, workshops and websites are also listed in this report.

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1 COLOSS OVERVIEW

COLOSS consists of about 80 members from around the world that conduct research with the aim to prevent honey bee colony losses. Research trials are conducted according to their interest in the five taskforces:

1. Varroa control (the workshop being reported on)
2. Honeybee breeding
3. Vesper (wasps)
4. Monitoring
5. BRAP – Bridging of research and practice

Each task force meets at least annually to report on research trials, discuss changing research focuses, set priorities and plan for future collaborative research. The 2016 workshop of taskforce 1 was held in Unije, Croatia, from 19 to 20 May 2016. The programme is shown in Appendix 1.

The goals of the varroa control taskforce are to:

- Increase effectiveness of beekeeping varroa management
- Study the impact of acaricides
- Understand mechanisms to varroa tolerance
- Develop diagnostic methods
- Develop breeding methods.

The goals are realised within working groups (WG). Currently there are three functioning WG (1, 2, 4), two newly established WG (5 & 6), and the possibility of a new WG (3):

<table>
<thead>
<tr>
<th>Working group</th>
<th>Focus</th>
<th>Coordinator</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Infestation assessments</td>
<td>Marco Pietropaoli, Italy</td>
<td>Compare methods to assess varroa infestation levels: Soap, alcohol, icing sugar and natural mite fall (NMF).</td>
</tr>
<tr>
<td>2</td>
<td>Honey bee brood interruption</td>
<td>Ralph Büchler, Germany</td>
<td>Compare the efficacy of oxalic acid and formic acid in association with a 25 day brood interruption.</td>
</tr>
<tr>
<td>3</td>
<td>Topic (Currently inactive)</td>
<td>Possibly Cecilia (surname unknown)</td>
<td>Currently inactive. Contact Cecilia regarding the establishment of the EU Smart Bees Project. WG may be about establishing varroa-threshold that causes damage to bees.</td>
</tr>
<tr>
<td>4</td>
<td>Formic acid management</td>
<td>Benjamin Dainat, Switzerland</td>
<td>Renamed at this meeting to include all organic products.</td>
</tr>
<tr>
<td>5</td>
<td>Assessing control methods</td>
<td>Maja Smodis Skerl, Slovenia</td>
<td>Newly established at this workshop.</td>
</tr>
<tr>
<td>6</td>
<td>Establishing control protocols for beekeepers</td>
<td>Victoria Soroker, Israel and Flemming Velsnaes, Denmark</td>
<td>Newly established at this workshop.</td>
</tr>
</tbody>
</table>

1.1 Varroa survivor breeding programme

Unije was selected for the workshop as it is the location of the collaborative Varroa-survivor breeding programme between Germany (Stefan Berg), Italy (contact undetermined), and Croatia (Nikola Kezic). Unije was selected for the location of the breeding programme because its location from the mainland enabled control over the introduction of honey bee genes to the
breeding programme. Unije is part of the Cres-Lošinj archipelago situated furthest west in the series of small open-sea Adriatic islands. The island is hilly, with the highest peak being Kalk at 138 m. The north-western open-sea coast is steep (Vele and Male Stijene), whereas the south-western part, with its small peninsula of Polje, has fertile land, loess and springs of drinkable water.

The programme was established 17 years ago to select for colonies that survived varroa. Colonies on Unije were initially owned by a single beekeeper and the queens of these colonies were replaced with 200 selected queens from contributing countries. Colonies are not treated for varroa so only the colonies that survive remain in the programme. The longest surviving colony, hive 109, survived for seven years although the colony in the latter years was not in any condition to collect a sizeable honey harvest. Other colonies have survived for a couple of years but no information about the success of these was remembered. Only natural mating was used, artificial insemination was not.

The mechanism behind the survival of Hive 109 remains undetermined. Before the death of colony 109, daughters were transferred to mainland Europe but were unable to survive without varroa control. Reasons for this inability to survive outside of the Unije Island environment did not appear to have been determined by the group. It is my opinion that there are two possible causes for the unsuccessful control of varroa by daughter colonies of hive 109. One possibility was that colonies were unable to control enough of the varroa (by whatever control mechanism may be occurring) because of an unprecedented entry of varroa from the surrounding mainland colonies (too many varroa entering the daughter colonies). A second possibility may be related to the open-mating of hive 109 daughters. As none of the colonies on Unije had their drones contained within the colonies (no drone excluders on the colony entrance), these hive 109 daughters were likely open-mated with drones from numerous lineages from around Europe, most of which died within a year of being introduced to the programme. It is therefore possible that the workers from hive 109 daughter-queens contained insufficient genetic material from the original queen to repeat what their predecessors had accomplished, thus preventing colony survival. These seem to be the most likely options, but there are others that are not discussed here.

The survivor-colony programme continues on Unije with additional colony introductions for survivor-testing, however, I was unable to determine the success-indicators of the breeding programme nor the future goals for the programme.

1.1.1 Conclusion: Varroa survivor breeding programme

A varroa-survivor breeding programme conducted in this manner is not a recommended option for New Zealand beekeeping. Open-mating means that progress would be slow and in the above case, this has taken 17 years with limited success. If breeding for varroa control traits within New Zealand honey bees is viewed as an important part of an integrated control programme then the success of the Varroa Sensitive Hygiene (VSH) breeding programme conducted in New Zealand by Plant & Food Research for the NBA should be realised. This programme, although not able to control 100% of varroa, successfully documented survival of colonies without spring treatments that also produced honey harvests. Breeding for varroa control traits in New Zealand could be an important component of an integrated control programme if a genetic test for VSH could be validated. Two New Zealand programmes still maintain the VSH genetic lines provided to them by PFR. The state of these lines are currently unknown by PFR and PFR does not actively select for any of these VSH lines.
2 WORKING GROUP REPORTS

The following is a summary of the research from the three current WG, ideas for two new WG and my personal comments.

2.1 Working group 1: infestation assessments

Led by Marco Pietropaoli, Italy. Compare methods to assess varroa infestation levels: soap, alcohol, icing sugar and natural mite fall (NMF).

Reported on a trial to identify the efficacy of icing sugar (I/S) at dislodging mites from bees in a sugar shake. Questions to answer:

1. Can I/S dislodge sufficient mites from bees?
2. Does the I/S method represent total colony infestation (phoretically alone or phoretically as well as mites in cells)?
3. How is the I/S method related to 10 days of natural mite fall (NMF)?
4. How does the 10-day NMF relate to colony infestation?
5. Can a model be developed that describes total colony infestation using percent infestation from I/S? The model needs to incorporate bees, brood, position of frame, and other variables that may interfere with infestation.

They have conducted a trial where they have assessed the following variables: bees, brood, bee sample position, bee weight, NMF over 10 days. These were compared with the number of bees, phoretic mites (queen was caged from day 10–35), and number of mites in I/S sample. The mites were retrieved, then washed in detergent (total mites in I/S compared with total mites after wash).

Conclusion: correlation of I/S to total colony infestation: \( R^2 = 0.44 \). Therefore, the I/S method is not a very good indicator of mites present in the colony. Possibly need to look at a threshold.

2.1.1 WG 1: M. Taylor comments

How the I/S method relates to colony infestation in New Zealand is unknown, but according to Vincent Dietemann from Switzerland, there is already a publication about the lack of correlation between 300 bees in icing sugar and total colony infestation, and that 900 bees is far more reliable. However, 300 bees has been used as it is more practical for beekeepers.

It is worth following research on how the correlation between the 300 bees in I/S and colony infestation can be increased by altering the bee collection parameters.
2.2 Working group 2: brood interruption

Led by Ralph Büchler, Germany. Compare management techniques to control varroa using oxalic acid or formic acid treatments associated with honey bee brood interruption. This can be achieved by:

1. Removing honey bee brood
2. Temporarily caging the queen for 25 days. The cage is 10 cm x 7 cm x 5 cm (queen excluder on both of these 5cm sides). The cage is put into a gap that is cut out of the top-middle of the frame.

The concept is that a break in the honey bee brood cycle interrupts the mites from reproducing, which means the mites become phoretic and should therefore be more easily killed using a control treatment at this time. The two natural times that this occurs are during swarming and in winter.

Trial: Mid Sep – Oct (autumn), 30 colonies used. Caged queen for 25 day in the above-mentioned cage and at day 7, 4.2% oxalic acid was trickled over the bees. No need for additional chemical control.

Protocol for WG2. Conduct trials but all use the same standard and control so can compare data and produce scientific publications. Then include different methods.

- Control= 2 strips Amitraz and 2 strips flumethrin for 6 weeks
- Standard= no brood removed, 4.2% trickle OA. Most suitable because tight brood nest in winter.
- N= 10 per treatment
- At least 2 apiaries. Block treatments across apiaries.
- Count mites 2 x per week (NZ do once per week)
  - On paper under mesh
  - Method (Ostiguy 2000) mite count analysis compare with Julien’s French research (no reference provided).
- Population assessments
  - Conduct pre-treatment colony assessments so colonies can be blocked across treatments.
  - 30 days post queen release, pre-winter, and spring
- Possible alternative treatments
  - Total brood removal for a period of time
  - Cage queen (using Varcontrol cages) and trickle 4.2% OA
  - Sublimation
  - Fogging
  - OA doses

Summer treatments may require alternative techniques like fogging, sublimation. Oxalic acid trickle designed for winter treatment. OA has contact effect not oral. Faster in summer. Sugar plus OA makes it remain longer in liquid so it spreads around the bees. Bees do not like the taste.

Increased sublimation (OA tablets on heating plate for 5 min) has fewer side effects on the bees but the same efficacy as trickle. The use of a heating plate would be time-consuming for
commercial beekeepers but perhaps it may be just a matter of getting enough of the correct equipment?

Need to look at risk of OA to human health when evaporated. German authorities (Büchler per.comm.) suggest if beekeepers use it carefully then no risk to human health.

### 2.2.1 WG 2: M. Taylor comments

New Zealand has only tested 3.4% oxalic acid not 4.2%. The legal use of 4.2% oxalic acid in New Zealand colonies needs to be confirmed. A spring brood interruption is not recommended for New Zealand beekeepers as the timing of brood removal is crucial to collecting a honey harvest and, because of our inclement weather, it is difficult to predict the exact date of the honey flow. Incorrect timing could result in beekeepers having a reduced honey crop:

<table>
<thead>
<tr>
<th>Time of brood removal in relation to harvest</th>
<th>Effect on honey harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 weeks before</td>
<td>Increase harvest</td>
</tr>
<tr>
<td>4 weeks before</td>
<td>Decrease harvest</td>
</tr>
<tr>
<td>6 weeks before</td>
<td>No change</td>
</tr>
</tbody>
</table>

New Zealand has a mild temperate climate so honey bee populations do not often experience a completely broodless period during winter. In other countries, this broodless period enables natural attrition of mites over winter. It may, therefore, be beneficial to create a broodless period at the end of autumn utilising the queen replacement regime with cells and conduct this simultaneously with the oxalic acid treatments that New Zealand beekeepers currently conduct.

There is potential to be involved in an international study (six to eight research groups in Europe) to determine the effect of brood break by requeening with cells and in association with a 4.2% oxalic acid treatment in autumn. Further discussion with a team in Israel will also continue because Israeli beekeepers have similar regimes to ours, e.g. replace queens with cells in autumn. It is likely that a joint trial will be conducted for publication. It would be good to include reliable New Zealand beekeepers that already requeen with cells in autumn and use oxalic acid treatment in autumn/winter.

### 2.3 Working group 3

Currently inactive.

### 2.4 Working group 4: formic acid management

*Led by Benjamin Dainat, Switzerland.* Identify intra-colony and environmental parameters to increase formic acid (FA) efficacy and produce base-line data.
Trials:

1. Formic acid efficacy trial protocol

   German apiaries N= 24, 48, 24, 40
   Swiss apiary N=30
   Short-term protocol of FA treatment at day 0 to control varroa.
   Long-term protocol of FA treatment (two treatments, one at start (Day 0) and one late summer (Day 57)) and one oxalic treatment in winter (Dec).
   Assess Natural Mite Fall (NMF): day 0, 21, 57, 61
   No results yet.

2. Humidity trial protocol

   Determine volatilisation assessment inside colony and compare without bees.
   These data will provide an online decision tool for beekeepers (website).
   Focus: what are the differences between colonies that produce variation in efficacy?

2.4.1 WG 4: M. Taylor comments

Plant & Food Research have previously determined the efficacy of four application methods of generic formic acid in relation to the other organic acid treatments. Goodwin et al. 2002. Development of integrated control programmes for Varroa control in New Zealand. Ministry of Agriculture and Forestry. This work, as well as the sampling method research, needs to be published to move this area forward and prevent a waste of international funds through repetition.

It would be useful to look at the mechanism behind formic acid efficacy as well as the efficacy of these new products in the New Zealand environment.

2.5 Working group 5: new treatment assessments

To be led by Maja Smodis Skerl, Slovenia.

The aim is to identify the effect of potential new varroa control treatments individually

Could be used to test efficacy for new varroa treatment products. Examples:

- Thermotherapy. This is an old idea. It is not a practical option for New Zealand commercial beekeepers as it would be too time consuming for beekeepers to remove the frames from the bees and colony and heat them up.
- Discussion around high efficacy of volatile treatments in winter or cold months. Warm comb, then add essential oils. The use of capped or uncapped brood.
- Varroa control protocols. Standardise comparison of protocols to apply against varroa during the year. Include beekeeper industry and training and input from other working groups e.g. WG 1 and WG 2.
- Hopguard™ efficacy

Possible questions to answer:

- Does temperature regulate varroa populations?
- Does distance between colonies interfere with varroa population?
- What is the sensitivity of varroa counting?
Discussion around testing new products for companies. There were several proprietary formic acid products being sold in Europe, most without good research on efficacy but with accounts of associated colony loss due to ineffective varroa control treatments. Comparative analysis, as conducted on the generic organic controls by PFR, was limited.

2.5.1 WG 5: M. Taylor comments

Testing every new chemical would be extremely costly. Parameters around when a product should be included in comparative tests should be determined, to weed out unlikely treatments. The mode of action of chemicals should be assessed to determine how products should be best applied.

2.6 Working group 6: varroa control protocols

To be led by Flemming (Denmark) and Victoria (Israel).

Join with BRAP to take the information to beekeepers.

Need to define goals.
3 ORAL PRESENTATIONS

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria Soroker</td>
<td>The effect of oxalic and formic acid treatments in Israel</td>
</tr>
<tr>
<td>Vincent Dietemann</td>
<td>Formic acid dispensers’ efficiency tests</td>
</tr>
<tr>
<td>Julien Vallon</td>
<td>Use of oxalic acid or formic acid (MAQS) in late spring</td>
</tr>
<tr>
<td>Michelle Taylor</td>
<td>Varroa control in New Zealand – what is next for commercial beekeepers?</td>
</tr>
<tr>
<td>Marco Pietropaoli</td>
<td>Icing sugar method: shaking the jar makes the difference</td>
</tr>
<tr>
<td>Michele Mortarino</td>
<td>Results of a WG4-FA trial in Northern Italy (was not present)</td>
</tr>
<tr>
<td>Martin Gabel</td>
<td>Summer brood interruption for vital honey bee colonies (results and experience from a study in Germany)</td>
</tr>
</tbody>
</table>

3.1 Abstracts (A) provided by research organisations and additional notes by Michelle Taylor (MT)

3.1.1 1A: The effect of oxalic and formic acid treatments in Israel. WG4

Ron Korkidi, Josef Kamer, Ilya Zaidman and Victoria Soroker
Department of Entomology, Institute of Plant Protection, The Volcani Center, Agricultural Research Organisation, Porter School, Tel Aviv University. E-Mail: sorokerv@agri.gov.il.

Today Varroa destructor along with viruses it transmits poses a main threat to the Israeli apiculture. Most of the beekeepers treat their colonies against the Varroa with recommended acaricides. After failure of treatment with coumaphos loaded strips (checkmite) due to resistance development, it is now recommended to treat colonies twice a year with Amitraz impregnated sticks. The methods seems quite effective at the moment, however, there is a concern that resistance will soon follow.

We aim at development of integrated Varroa management scheme that will combine a number of approaches and will consider resistance management. As part of this effort we tested the efficacy of 1) oxalic acid treatment with queen caging during early autumn and 2) formic acid MAQs+ strips (1 or 2 per super) during winter time. The results of these trials will be presented and discussed.

3.1.2 1 MT

Conclusions: 1) OA plus queen caging in autumn appeared to be as effective as Amitraz. Safe for bees during autumn, even at high temp. Need gloves and mask.

This would be interesting to test in the New Zealand environment. The efficacy of OA in previous PFR trials was always significantly lower than synthetic treatments and not enough to control varroa as a stand-alone product.

MAQs 45% FA on the label. There was discussion about how much FA is actually released into the colony. Entrance of colony appears to be important. 1.3cm min.
1-day post treatment, single super, lots of dead bees on the floorboard. Winter temp was <10°C at night, <20°C during the day. Final results as effective as Amitraz (no major honey bee population impact).

Again it would be interesting to test this in New Zealand environment. Previously, we have had limited success with FA treatments in New Zealand. However most of the tests were conducted using generic FA in autumn, rather than winter.

### 3.1.3 2A: Formic acid dispensers efficiency tests. WG4

Benjamin Dainat and Vincent Dietemann  
Swiss Bee Health Extension Service; Schwarzenburgstrasse 161, 3003 Bern, Switzerland  
E-Mail: vincent.dietemann@agroscope.admin.ch

The comparison of efficiency of a range of new and older formic acid dispensers for the control of *Varroa destructor* under Swiss conditions draws to an end. The four tested dispensers had a high average efficiency against *Varroa destructor*. However, variation in efficiency was also high between the nine apiaries tested due to the large temperature and humidity differences between these sites. We will outline the results obtained to this point and discuss how to compile the data from all other teams who performed the experiment for statistical analysis as well as establish how to carry on with the work of this working group.

#### 3.1.4 2 MT

9 apiaries, n= 164 colonies. Single super. FA treated August, September and December (winter).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Description</th>
<th>Mean efficacy (%)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nassenheider Pro (N-pro)</td>
<td>85</td>
<td>Large variation in efficacy</td>
</tr>
<tr>
<td>2</td>
<td>Lieburg (Lg)</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>MAQs</td>
<td>*</td>
<td>9/30 Queens dead</td>
</tr>
<tr>
<td>4</td>
<td>Fan</td>
<td>78</td>
<td></td>
</tr>
</tbody>
</table>

*Low efficacy but no time to record

Temperature and humidity thought to cause large variation in efficacy.

The large variation was similar to what PFR have observed in all previous trials using generic formic acid. Now that resistance is starting to occur, it may be worthwhile revisiting/reminding industry of FA efficacy. Still dangerous for beekeepers to use. Need correct training.

### 3.1.5 3A: Use of oxalic acid or formic acid (MAQS) in late spring. WG 2

Julien Vallon  
ITSAP-Institut de l’abeille; Avignon; France  
Email: julien.vallon@itsao.asso.fr
The ITSAP-Institut de l’abeille is a French organisation for extension that coordinate experiment and research in beekeeping. Involved in the UMT PrADE with the INRA in Avignon, experiments are done in regional beeyards with the network of the ADAs (Regional associations for beekeeping extension). In the bee health department, researches are focused on Varroa treatment and the test of new methods or new treatments in beekeeping real conditions.

The optimization of use of organic acids with brood removal or queen cage is experimented in some ADAs for the last years. In 2016 we get a support to test caging queens and the use of oxalic acid at the end of the season. The main lines of the protocol are: 4 experimental beeyards located in south France and 40 colonies per beeyard (4 groups of 10 hives). Queens will be locked up 25 days in Scalvini cage before oxalic acid application, using trickling or vaporization (Sublimox®). Treatment efficacy (i.e. counting dead Varroa mites during treatment and control treatment) and colonies evolution (i.e. weight, estimations of bee, brood and food quantities) will be observed in order to compare the use of homemade treatment with dihydrated oxalic acid that beekeepers used to employ still now, and Apibioxal®, a new treatment from Chemicals Laif (Italy), recently registrated in France (2015).

The experiment will be done from August to November 2016 by ADAAQ (Aquitaine), ADAM (Midi Pyrénées), ADAPro LR (Languedoc Roussillon) and ADAPI (PACA) and coordinated by ITSAP-Institut de l’abeille.

3.1.6 3 MT

2014 assessed MAOs (FA), 2015 assessed MAOs, BeeVital® HiveClean (active ingredient unknown) and ApiLifeVar (thymol), 2016 Api-Bioxal (OA) as summer treatments. No results as of yet. Apibioxal® has not been assessed in New Zealand. Wait for these results to determine whether this may be a useful product.

3.1.7 4A: Icing sugar method: shaking the jar makes the difference. WG1

Marco Pietropaoli, Jorge Rivera Gomis, Giovanni Formato
Istituto Zooprofilattico Sperimentale del Lazio e della Toscana “M. Aleandri”; Rome; Italy
Email: marco.pietropaoli@izslt.it ;giovanni.formato@izslt.it

We compared two different protocols to evaluate Varroa infestation level inside honey bee colonies adopting the icing sugar technique. The first method was the same proposed in the COLOSS Varroa Task Force Working Group 1: from one external honey frame, we took an amount of foragers bees sufficient to fill a 120ml container; we poured the bees from the 120ml container into a jar with 35g of fresh icing sugar; we closed the cap and gently rotated it with hands in 60 seconds and leaved for 3 minutes in vertical position; we shook for a couple of minutes the content of the jar (also with sidewall knock) through the screen lid and counted the number of Varroa mites. From the same frame, we realized another sample of bees and applied the second protocol where the amount of bees and the procedure was similar and the only difference was that, after the rotation with hands of the jar, we leaved it in vertical position, cap down in order to bring down from the screen lid the Varroa mites, without shaking it. The samples of bees, after the icing sugar methods above described, were immediately brought to the laboratory to check for the residual mites with the OIE alcohol wash method. Results: The percentage of mites collected with the first protocol, the same proposed in the COLOSS Varroa Task Force Working Group 1, was 95.8%±7.2%; on the contrary, the percentage of mites dislodges with the second protocol (without shaking the jar) was 69.3%±18.8%. Results
obtained from these field trials showed that shaking the jar is very important to increase the number of mites collected with the icing sugar method. Correlation of mites infestation and mites retrieved from jar using I/S was 0.44.

3.1.8 4 MT

There was a lot of discussion around what the efficacy of assessment methods were. My opinion is that we already have good understanding around this issue so it is unnecessary to follow this line of research. Refer to MAF publication SFF Goodwin et al. 2002. Development of varroa control programmes for varroa control in New Zealand. PFR methodology should be published to move this area of research forward and prevent waste of international research funds. New Zealand method: 95.1% retrieval rate if use 2 sugar shakes, 10g icing sugar per time. Roll jar to mix bees and sugar (ca. 3 times), shake upside down until all varroa are retrieved (between 15–30 seconds). 96.8% for 3 shakes.

What is of interest is the relevance of this method in relation to the entire varroa population as discussed under WG1 report. Their continued goals are to:

- Improve I/S jar technique
- Look at threshold # (number of varroa per 300 bees) requires treatment

The latter is of interest as it tells beekeepers when they need to treat, otherwise their colony will die. However, the concern is that this number will change with time, season, and development of viruses so this could be costly to determine for a limited lifespan. PFR analysed these types of data in 2002 (Goodwin et al. 2002) and we found that colonies with >100 mites / 300 bees, despite looking healthy, were dead within a month. As a precaution, beekeepers were advised to treat if there were >40 mites /300 bees. The actual economic threshold is difficult to determine and is likely to have reduced by now due to an increase in viruses that are vectored by varroa.

3.1.9 5A: Results of a WG4-FA trial in Northern Italy

Michele Mortarino1, Livio Colombari2, Giovanni Prestini3, Elena Facchini4, Giovanni Formato5

1Università di Milano, Dipartimento di medicinaveterinaria; Italy; 2Apilombardia, Voghera (PV), Italy; livio.colombari@gmail.com; 3ATS Brianza; Monza; Italy; giovanni.prestini@ats-brianza.it; 4Università di Milano; Italy; elena.facchini@unimi.it; 5IZSLT; Roma; Italy; giovanni.formato@izslt.it, Email: michele.mortarino@unimi.it

A field trial was performed during summer 2015 to evaluate tolerability and efficacy of liquid formic acid treatment as part of the activity of the Coloss Task Force for Varroa Control, Working Group 4. The apiary was located in the municipality of Calco, Northern Italy, in a hilly environment, around 320 mts above sea level. The experimental protocol was adapted to the Short Term Protocol designed by the WG4 (coordinators. B. Dainat and G. Formato). Three different experimental groups, each made of 6 colonies hosted in Dadant-Blatt hives, were included in the trial: group 1, treated with 60% liquid formic acid administered for 10 days using Nassenheider Evaporator Professional; group 2, treated with MAQS® formic acid strips for 7 days following the Instructions for use by the manufacturer; group 3, left untreated. Supers were not used, and external and in-hive parameters like temperature and relative humidity were recorded during the treatment using iButton dataloggers. The strength of the colonies was evaluated before the treatment. At the end of the treatment, strength were evaluated again and
the queen were confined in VarControl® cages. After 22 days of caging, the queen were released and a follow up treatment was performed in all the hives by trickling oxalic acid sucrose solution. During the trial, the mite fall of each colony was recorded weekly, and adverse effects were monitored. Overall, the tolerability of the two formic acid preparations were similar, with a decrease of the amount of sealed brood compared to untreated control. One queen from the Neissenheider group was lost after the treatment. Also the effectiveness against varroa was comparable between the two treatments, and significantly higher compared to the natural fall recorded in the untreated group.

3.1.10 5 MT:

Giovanni briefly discussed Michele Mortarino’s results. Humidity reader was 120% but temp data ok. Perhaps datalogger was in a pool of water to produce false humidity readings?

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Description</th>
<th>Mean efficacy (%)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nassenheider Pro (N-pro)</td>
<td>72</td>
<td>Large variation in efficacy</td>
</tr>
<tr>
<td>2</td>
<td>Untreated control</td>
<td></td>
<td>Low efficacy but no time to record</td>
</tr>
<tr>
<td>3</td>
<td>MAQs</td>
<td>70</td>
<td>9/30 Queens dead</td>
</tr>
</tbody>
</table>

FA efficacy appears to be around 70% in Italy.

3.1.11 6A: Summer brood interruption for vital honey bee colonies (results and experience from a study in Germany) WG2

Brood interruption, by the methods of caging queen or brood removal, are known beekeeping methods for control Varroa destructor in honey bee colonies (Apis mellifera L.) in some south European regions. By using the foremost method, the beekeepers are able to force the mites in the phoretic phase in order to efficiently treat the colonies (for instance with organic acids). By the second method the beekeepers in fact remove the mites alongside with the detached sealed brood and delay following reproduction cycles of remaining mites. However, at present time we are lacking an experience and knowledge when these methods are applied as summer treatment under central European conditions. Therefore, we investigate in our study the effect of the above mentioned methods on the colonies’ overall development, health status and overwintering ability compared to the common used method in Germany (control group). The study was set up in July 2015 on an apiary near Kirchhain (central Germany) where 30 colonies were arranged into five groups. In three groups (CJ, CA, CS) we caged the queens for 25 days to treat the broodless colonies by trickling an aqueous solution of oxalic acid (3.5% m/V) afterwards. This method was applied in July (CJ), August (CA) and September (CS). In another group (BR) we removed the entire brood in July with subsequent use of a trapping-comb. The control group (FA) was treated with 60% formic acid in July following the common local practice in this region. Once per month we estimated the number of bees and brood cells with a modified “Liebefeld-method” in each colony and took bee samples to detect Varroa-infestation from July to October 2015 and in April 2016. Additional samples were taken in July, October and April to
detect *Nosema sp.* and four viruses (CBPV, ABPV, DWV, SBV). All colonies were treated with Perizin® in January 2016 to keep the Varroa-infestation under the threshold level. With a few exceptions, we found no difference between the treatments relating to the overwintering ability or the other parameters in July, October and April (results for *Nosema sp.* will be discussed on the workshop). Before wintering (October) CA showed a sig. bigger brood amount than all other groups (p = 0.001). The Group CS showed a sig. higher Varroa infestation in October (p = 0.018) than FA and CA. We observed two queen losses (BR, CA) in November 2015, though, these seems to be no effect of the methods. Until now our results suggest that CJ and CA could be useful alternatives for Varroa-control under central European conditions without negative effects on the colonies. Even apart from the studied parameters, the described methods seem to be useful approaches for hive management in central Europe. They are easy to apply, efficient for Varroa-management and quick in colony multiplication at the same time.

3.1.12 6 MT

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No difference between amount of bees, brood, viruses, or *Nosema* across treatments. The treatment where queens were caged in August (QA) were the strongest and had the most brood before winter. The QS (autumn treatment) had the most infestation, as expected because the mites had the longest time period to develop.

Brood interruption is not a well-practised varroa control method used by New Zealand beekeepers. A slight interruption occurs when queens are replaced using cells but only when the old queen is removed previously. WG2 advocates a 25 day brood break to allow for the youngest brood (eggs) to emerge. For a trial to be conducted in New Zealand, 2-day-old cells could be used and the queen would need to be removed 2 days prior to cell introduction, or at least caged for this length of time.

The above study assessed brood removal in mid-summer. Remember these are conducted on hobbyist colonies. This is not advised, as discussed in the section Working Group Reports WG2.

3.2 General notes

3.2.1 Varroa counts by beekeepers

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Switzerland: Benjamin Dainat. Mite counting has not been common among beekeepers but the new generation of beekeepers are starting to count mites to understand when to treat. Assessment methods were not specified.

Vincent. Approximately 5% beekeepers count mites.

Assessing mites on 300 bees is not a reliable indicator for mite populations in the colony. Apparently this is well known

3.2.2 Formic acid efficacy

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Benjamin Dainat. Switzerland beekeepers are predominantly hobbyist. Mite Away = 50–90% efficacy. Dispenser = 70–90% efficacy.
3.2.3 Varroa treatment weather website

A varroa treatment weather website is utilised by some beekeepers in Germany and Denmark. The website looks at weather temperature in specific regions and predicts the most effective time over the next seven days to apply varroa control treatments of formic acid, oxalic acid and thymol.

The green plus symbols indicate the most optimal days for treating with formic acid or oxalic acid based on the weather conditions, the red arrows indicate it will be too hot for treatment and the blue arrows indicate the weather will be too cold for treatment. Yellow circles suggest it will be suitable to treat but not optimal.

3.2.4 Nosema

Vicki. Israel. Nosema ceranae only present. Trial 1: Nucleus colonies (nucs) fed 70% pollen patty v. 7% pollen patty. Nosema increased in 7% treatment. Trial 2: Nosema increased in commercial hives that had pollen patties when assessed using a microscope. Why did this
occur? A PCR assessment found Nosema was not higher in the pollen patty treatments. They concluded starch particles in pollen appeared as Nosema if using the microscope for assessment. It would be interesting to determine if this is so.

Dariusz, Poland. *N. ceranae* causes stunted summer growth in honey bee colonies. They only have 4 month season. Is this similar to what we are seeing in Coromandel?

### 3.2.5 Honeybee microbiota

Iratche and Andone from Basque Country, Spain are commencing research this year on honey bee gut microbiota and comparing across hives as I am. We discussed the DNA extractions I have used so we may be able to conduct a comparative analysis in the future.

Use the Microbial ecology R package called VEGAN to analyse microbial data but QIIME is easier.

Maja, Slovenia. Research on effect of diet on hypopharyngeal gland. Janez Presern suggested it may be possible to get a bilateral grant for travel and costs between the countries if collaborative research was of interest.

Varroa Sensitive Hygiene

Vicki, Israel was interested in Israel establishing a VSH programme but Mark Goodwin advised Israel not to pursue it, presumably because of the time and monetary commitment required. She is still interested but the funding has currently been diverted.

### 3.2.6 Varroa tolerance

Giovanni, Italy. They have published tolerance control papers on an isolated population of Italian bees that have survived without varroa control. The mechanism has not been determined and has not been replicated anywhere else. It is my opinion that the variable factors that may be involved could be verified but it is unlikely that this will occur as the trial has been completed. The possible factors include: 1) the large brood break that these colonies experience in winter, 2) the isolation from additional sources of varroa that enable the colonies to tolerate varroa, and 3) a genetic influence.

### 3.2.7 Macedonia queen replacement

Kill queen, after 9 days kill cells and add mated queen.

### 3.2.8 2016 COLOSS questionnaire – honey bee colony losses

COLOSS conducts an annual colony loss questionnaire containing 23 questions to collate information from European countries about factors that may be influencing colony loss. The data is compared across countries and trends are highlighted. The results are published annually. The United States of America (USA) previously provided USA data to this group but have recently ceased to be involved to focus on questions more specific to their industry. New Zealand is welcome to monitor honey bee colony losses and be included in the COLOSS press release. This would be achieved by beekeepers completing the survey and returning the data to Alison Gray (a.j.gray@strath.ac.uk) for analysis no later than 1st July 2016. ALL of the essential
questions marked with a black circle must be included for the data to be considered in the press release.

The international coordinators of the COLOSS core project on monitoring colony losses are: Alison Gray [a.j.gray@strath.ac.uk] and Robert Brodschneider [Robert.brodschneider@unigrad.at]. I have a copy of the questionnaire.

The value of sending our data to the COLOSS group would be for comparison of our industry in relation to the effect of varroa control treatments on colony loss. As this is published annually it may provide insight to better control methods. However, the European information could still be utilized without providing any NZ data and as the majority of European industries are predominantly hobbyist, there may be more value gained from comparing our data with countries with varroa that have commercial beekeepers with similar hive numbers hives (> 500) such as USA, Canada etc.

A coordinated approach would be required to gather sufficient information for colony loss trends to be observed. Greater benefit may be realized if the questions were more specific to the New Zealand beekeeping environment. The value of collecting colony loss data for inclusion in international publications should be discussed in further detail.

### 3.3 Upcoming conferences and workshops

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Title</th>
<th>Website</th>
<th>Rego/Abstract due</th>
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<tr>
<td>7-9 September 2016</td>
<td>Romania</td>
<td>EuroBee (ca. 200 people)</td>
<td><a href="http://www.coloss.org/events/12th-coloss-conference-romania">www.coloss.org/events/12th-coloss-conference-romania</a></td>
<td>1/8/2016</td>
</tr>
<tr>
<td>10-11 September 2016</td>
<td>Romania</td>
<td>COLOSS</td>
<td></td>
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<tr>
<td>13-15 October 2016</td>
<td>Switzerland</td>
<td>Bee Health</td>
<td><a href="http://www.tibees.ch">www.tibees.ch</a></td>
<td>15/7/2016</td>
</tr>
<tr>
<td>22-25 November 2016</td>
<td>Rome</td>
<td>Apiquality &amp; Apimedica</td>
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</table>

### 3.4 Websites of Interest

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<tr>
<th>Name</th>
<th>Contact</th>
<th>Description</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varroawetter</td>
<td>Stefan Berg</td>
<td>Predictor to apply 60–85% formic acid and thymol based on weather conditions. Denmark has bought a copy at 2500 Euro set-up then 1500 Euro p.a.</td>
<td><a href="http://www.apiservice.ch">www.apiservice.ch</a></td>
</tr>
<tr>
<td>Benjamin Dainat</td>
<td>Varroa control protocols</td>
<td></td>
<td><a href="http://www.genomic-resources.eus">www.genomic-resources.eus</a></td>
</tr>
<tr>
<td>Genomic resources</td>
<td>Iratche Zarraonaindia</td>
<td>Use for genomic resource analysis</td>
<td></td>
</tr>
<tr>
<td>Colevol</td>
<td>Julien Vallon</td>
<td>Software to analyse frames of brood/bees</td>
<td></td>
</tr>
</tbody>
</table>
## 3.5 Workshop attendees and notes

<table>
<thead>
<tr>
<th>Name</th>
<th>Institute</th>
<th>Country</th>
<th>Email</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berg Stefan</td>
<td>Bavarian State Institute for Viticulture and Horticulture, Bee Research Center</td>
<td>Veitshöchheim, Germany</td>
<td><a href="mailto:stefan.berg@lwg.bayern.de">stefan.berg@lwg.bayern.de</a></td>
<td></td>
</tr>
<tr>
<td>Büchler Ralph</td>
<td>Landesbetrieb Landwirtschaft Hessen, Bee institute</td>
<td>Kirchhain, Germany</td>
<td><a href="mailto:ralph.buechler@llh.hessen.de">ralph.buechler@llh.hessen.de</a></td>
<td></td>
</tr>
<tr>
<td>Charistos Leonidas</td>
<td>Institute of Animal Science – Division of Apiculture</td>
<td>Chalkidiki, Greece</td>
<td><a href="mailto:leoharistos@instmelissomias.gr">leoharistos@instmelissomias.gr</a></td>
<td></td>
</tr>
<tr>
<td>Dainat Benjamin</td>
<td>Swiss Bee Health Extension Service</td>
<td>Bern, Switzerland</td>
<td><a href="mailto:benjamin.dainat@apiservice.ch">benjamin.dainat@apiservice.ch</a></td>
<td></td>
</tr>
<tr>
<td>Dietemann Vincent</td>
<td>Swiss Bee Research Center</td>
<td>Bern, Switzerland</td>
<td><a href="mailto:vincent.dietemann@agroscope.admin.ch">vincent.dietemann@agroscope.admin.ch</a></td>
<td>2 commercial bkpr = 300 hives each. Rest hobbyist.</td>
</tr>
<tr>
<td>Estonba Andone</td>
<td>University of the Basque Country</td>
<td>Leioa-Bilbao Spain, (Basque Country)</td>
<td><a href="mailto:andone.estonba@ehu.eus">andone.estonba@ehu.eus</a></td>
<td></td>
</tr>
<tr>
<td>Filipi Janja</td>
<td>University of Zadar</td>
<td>Zadar, Croatia</td>
<td><a href="mailto:filipi@unizd.hr">filipi@unizd.hr</a></td>
<td></td>
</tr>
<tr>
<td>Formato Giovanni</td>
<td>Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana “M. Aleandri”</td>
<td>Roma, Italia</td>
<td><a href="mailto:giovanni.formato@izslt.it">giovanni.formato@izslt.it</a></td>
<td></td>
</tr>
<tr>
<td>Gabel Martin</td>
<td>Landesbetrieb Landwirtschaft Hessen - LLH Bieneninstitut, Kirchhain</td>
<td>Kirchhain, Germany</td>
<td><a href="mailto:gabel-martin@gmx.de">gabel-martin@gmx.de</a></td>
<td>BSc student</td>
</tr>
<tr>
<td>Gerula Dariusz</td>
<td>Research Institute of Horticulture in Skieniewice Pulawy</td>
<td>Poland</td>
<td><a href="mailto:dariusz.gerula@inhort.pl">dariusz.gerula@inhort.pl</a></td>
<td></td>
</tr>
<tr>
<td>Golubovski Miroljub</td>
<td>Macedonian Association for conservation of Macedonian local honey bee</td>
<td>Republic of Macedonia</td>
<td><a href="mailto:mgolubovski@yahoo.com">mgolubovski@yahoo.com</a></td>
<td></td>
</tr>
<tr>
<td>Goudkov Ivan</td>
<td>Retired</td>
<td>TOULOUSE, Faouette</td>
<td><a href="mailto:ivangoudkov@yandex.ru">ivangoudkov@yandex.ru</a></td>
<td></td>
</tr>
<tr>
<td>Jenko Rogel Mira</td>
<td>Veterinary Faculty National Veterinary Institut</td>
<td>Naklo, Slovenia</td>
<td><a href="mailto:mira.jenkorogel@vf.uni-lj.si">mira.jenkorogel@vf.uni-lj.si</a></td>
<td></td>
</tr>
<tr>
<td>Kezić Nikola</td>
<td>Principal breeder on Unije. Father of Janja</td>
<td>Zagreb, Croatia</td>
<td><a href="mailto:nikola.kezic@zg.t-com.hr">nikola.kezic@zg.t-com.hr</a></td>
<td></td>
</tr>
<tr>
<td>Kovačić Marin</td>
<td>University JJ Strosmayer, Faculty of Agriculture</td>
<td>Osijek, Croatia</td>
<td><a href="mailto:komarin@pfos.hr">komarin@pfos.hr</a></td>
<td></td>
</tr>
<tr>
<td>Mortarino Michele</td>
<td>Dipartimento di Medicina Veterinaria - Universita' Degli Studi di Milano</td>
<td>Milano, Italy</td>
<td><a href="mailto:michele.mortarino@unimi.it">michele.mortarino@unimi.it</a></td>
<td>Did not attend.</td>
</tr>
<tr>
<td>Nanetti Antonio</td>
<td>CREA-API Uniti di Apicoltura e Bachicoltura, Consiglio per la Ricerca in Agricultura e l'Analisi dell'Economia Agraria</td>
<td>Bologna, Italy</td>
<td><a href="mailto:antonio.nanetti@crea.gov.it">antonio.nanetti@crea.gov.it</a></td>
<td></td>
</tr>
<tr>
<td>Pavlov Borce</td>
<td>Macbee Skopje</td>
<td>Republic of Macedonia</td>
<td><a href="mailto:pavlovborce@yahoo.com">pavlovborce@yahoo.com</a></td>
<td>He is a BKPR. 300 hives. 15kg honey /hive. Short flow. If wet or dry no crop. So needs to have diverse income (honey, pollen, royal jelly, venom (20-30E/g, queens)). Last treated with Fluvalinate in 2001. Winter (end Dec) 3.4% OA 5ml / frame. Brood starts end Jan. Spring (April-May) no trmt.</td>
</tr>
<tr>
<td>Name</td>
<td>Institute</td>
<td>Country</td>
<td>Email</td>
<td>Notes</td>
</tr>
<tr>
<td>--------------</td>
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</tr>
<tr>
<td>Pietropaoli Marco</td>
<td>Istituto Zooprofilattico Sperimentale del Lazio e della Toscana &quot;M. Aleandri&quot;</td>
<td>Rome, Italy</td>
<td><a href="mailto:marco.pietropaoli@izslt.it">marco.pietropaoli@izslt.it</a></td>
<td>Aug-Sept (after harvest) 100 hives that are moved for honey harvest are treated with 2 puffs 10% thymol fogging in paraffin oil x4 at 5-day intervals. FA not good for Macedonia as temp too high &gt;40C. Colony loss 10%. Replace in spring from autumn nucleus colonies.</td>
</tr>
<tr>
<td>Presern Janez</td>
<td>Agricultural Institute of Slovenia</td>
<td>Ljubljana, Slovenia</td>
<td><a href="mailto:janez.presern@kis.si">janez.presern@kis.si</a></td>
<td></td>
</tr>
<tr>
<td>Puškadija Zlatko</td>
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<td>Osijek, Croatia</td>
<td><a href="mailto:pzlakto@pfos.hr">pzlakto@pfos.hr</a></td>
<td></td>
</tr>
<tr>
<td>Rivera Gomis Jorge</td>
<td>Istituto Zooprofilattico Sperimentale del Lazio e della Toscana &quot;M. Aleandri&quot;</td>
<td>Rome, Italy</td>
<td><a href="mailto:jorge_rg_91@hotmail.com">jorge_rg_91@hotmail.com</a></td>
<td></td>
</tr>
<tr>
<td>Skerbis Suzana</td>
<td>Veterinarska fakulteta, Nacionalni veterinarski institut, Enota Nova, Gorica</td>
<td>Nova Gorica, Slovenia</td>
<td><a href="mailto:Suzana.Skerbis@vf.uni-lj.si">Suzana.Skerbis@vf.uni-lj.si</a></td>
<td></td>
</tr>
<tr>
<td>Smodiš Škerl Maja Ivana</td>
<td>Kmetijski inštitut Slovenije, Agricultural institute of Slovenia</td>
<td>Ljubljana, Slovenia</td>
<td><a href="mailto:maja.smidis.skerl@kis.si">maja.smidis.skerl@kis.si</a></td>
<td></td>
</tr>
<tr>
<td>Soroker Victoria</td>
<td>ARO, the Volcani center</td>
<td>Bet Dagan, Israel</td>
<td><a href="mailto:sorokerv@agri.gov.il">sorokerv@agri.gov.il</a></td>
<td>Approx 500 bkpr. 90% hobbyist. Commercial bkprs have majority of hives. Same institute as Arnon Daag (Visiting Scientist 2012).</td>
</tr>
<tr>
<td>Taylor Michelle</td>
<td>The New Zealand Institute for Plant &amp; Food Research Ltd</td>
<td>Hamilton, New Zealand</td>
<td><a href="mailto:Michelle.taylor@plantandfood.co.nz">Michelle.taylor@plantandfood.co.nz</a></td>
<td></td>
</tr>
<tr>
<td>Uzunov Aleksandar</td>
<td>Landesbetrieb Landwirtschaft Hessen, Bieneninstitut Kirchhain, Germany</td>
<td>Kirchhain, Germany</td>
<td><a href="mailto:Aleksandar.Uzunov@llh.hessen.de">Aleksandar.Uzunov@llh.hessen.de</a></td>
<td>Com bkpr = 1000 colonies. Spring = flumethrin, autumn = amitraz, winter 3.5% OA. Originally from Macedonia.</td>
</tr>
<tr>
<td>Vallon Julien</td>
<td>ITSAP-Institut de l’abeille</td>
<td>Avignon, cedex 9, France</td>
<td><a href="mailto:julien.vallon@itsao.asso.fr">julien.vallon@itsao.asso.fr</a></td>
<td>OA cell notes.</td>
</tr>
<tr>
<td>Vejsnæs Flemming</td>
<td>Danish Beekeepers Association</td>
<td>Sore, Denmark</td>
<td><a href="mailto:fv@biavl.dk">fv@biavl.dk</a></td>
<td></td>
</tr>
<tr>
<td>Wubie Abebe</td>
<td>Jenberie, Apiculture Research Institute, CAAS</td>
<td>Beijing, China</td>
<td><a href="mailto:ajenberie@gmail.com">ajenberie@gmail.com</a> <a href="mailto:ajenberie@126.com">ajenberie@126.com</a></td>
<td></td>
</tr>
<tr>
<td>Zarraonaindia Iratxe</td>
<td>University of the Basque Country</td>
<td>Leioa-Bilbao, Spain, (Basque Country)</td>
<td><a href="mailto:iratxe.zarraonaindia@ehu.eus">iratxe.zarraonaindia@ehu.eus</a></td>
<td>Hubert 2016, Microbiota in varroa compared with worker h/b.</td>
</tr>
</tbody>
</table>
4 INTERIM PROPOSAL: OXALIC ACID AND BROOD INTERRUPTION TRIAL

4.1 Proposed trial as a result of attending the workshop

**Aim:** To determine the efficacy of a 4.2% oxalic acid treatment to control *Varroa destructor* when conducted after honey bee brood has been interrupted for 25 days using queen cells in autumn.

4.2 Background

There are two times throughout the honey bee season that a break in the brood cycle occurs naturally: swarming and winter. These broodless periods interrupt the mites from reproducing, which results in natural attrition of the mites. The concept is that creating a break in the honey bee brood cycle means the mites become phoretic and a control treatment at this time may more effectively reduce the varroa population.

New Zealand has a mild temperate climate so honey bee populations do not often experience a completely broodless period during winter. It may therefore be beneficial to create a broodless period at the end of autumn and incorporate this into the queen replacement and oxalic acid treatment regime that New Zealand beekeepers currently utilise.

Using the natural brood interruption that occurs during swarming is not a recommended practice for New Zealand beekeepers as the timing of brood removal is crucial to collecting a honey harvest and, because of our inclement weather, it is difficult to predict the exact date of the honey flow. Incorrect timing could result in beekeepers having a reduced honey crop.

4.3 Methods

N = minimum 10 per treatment. Conduct using block treatment design on two sites.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Application Start</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 COLOSS Control</td>
<td>Day 25</td>
<td>Day 25: 4.2% Oxalic acid trickled between the bars within the brood nest at 5ml per frame of bees. Day ?: Amitraz 6 weeks.</td>
</tr>
<tr>
<td>2 Amitraz Control</td>
<td>Day 0</td>
<td>Day 1: 2 strips Amitraz per super. Total 4. Day 5: Insert queen (Q) cell (to ensure Q take should we add 2?) Day 15: Check colony for eggs. (Should we insert mated Q from nuc established at same time if no eggs?) Day ?: New Amitraz 6 weeks.</td>
</tr>
<tr>
<td>3 Brood interruption</td>
<td>Day 0</td>
<td>Day 0: Cage queen (Q) to create 25 day broodless period. Day 5: Insert Q cell (to ensure Q take should we add 2?) Day 15: Check colony for eggs. (Should we insert mated Q from nuc if no eggs?) Day 25: 4.2% oxalic acid trickled between the bars within the brood nest at 5ml per frame of bees. Day ?: Amitraz 6 weeks.</td>
</tr>
</tbody>
</table>

New Zealand colonies: 2 supers, each containing 9 frames (total 18 frames). Count frames of brood and bees: Day -3, Sticky board assessments: weekly from Day 0. Use of sticky boards supplied by Ecrotek NZ.
Time line:

<table>
<thead>
<tr>
<th>Day</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>Count frames of bees and brood</td>
</tr>
<tr>
<td>-2</td>
<td>Graft larvae</td>
</tr>
<tr>
<td>0</td>
<td>Kill queen &amp; put in 2-day-old cell</td>
</tr>
<tr>
<td>11</td>
<td>Queen emerges</td>
</tr>
<tr>
<td>14</td>
<td>Queen mates</td>
</tr>
<tr>
<td>18</td>
<td>Queen lays</td>
</tr>
<tr>
<td>25</td>
<td>Sealed brood present in colony</td>
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5 REFERENCES

Ralph Büchler, 2016. Personal communication at the COLOSS workshop and supported by Suzana Skerbis from Slovenia.

Nancy Ostiguy, Diana Sammataro. A simplified technique for counting Varroa jacobsoni Oud. on sticky boards. Apidologie, Springer Verlag, 2000, 31 (6), pp.707-716. <10.1051/apido:2000155>. <hal-00891743> https://hal.archives-ouvertes.fr/hal.
APPENDIX 1. INFORMATION ABOUT THE ISLAND OF UNIJE

There is only one settlement on the island of Unije. It is a typical fishing and farming village which contains 280 houses. The population of Unije is less than 85 residents which grows to more than 400 residents during the summer tourist season. There is no automobile traffic on the island. Accommodation was organised in multi-bed rooms (2 to 3 persons) in private houses. The price for accommodation was 20 EUR per night per person. Breakfast, lunch and dinner were at the local restaurant/bar.
APPENDIX 2. PROGRAMME FOR COLOSS – VARROA CONTROL TASKFORCE WORKSHOP

18 May 2016

20.00 Welcome dinner

19 May 2016

9:00 – 9:30 Registration
9:30 – 10:15 Welcome and general presentation of Varroa control Task Force
   Nikola Kezic - Ralph Büchler – Giovanni Formato
   WG 1. Infestation assessments - Marco Pietropaoli
   WG 2. Brood interruption - Ralph Büchler
   WG 4. Formic acid management - Benjamin Dainat
10:15-11:45 Separated meeting within each working group to discuss protocols, results, strategies.
11:45 – 12:45 Oral presentations
12:45-13:00 Discussion
13:00 – 14:30 Lunch
14:30 – 16:30 Separated meeting within each working group to discuss protocols, results, strategies.
16:30 – 18:00 Plenary session
18:00-19:30 Single WG presentations of results and perspectives (WG1, WG2, WG4)
19:30 Dinner

20 May 2016

8:30 – 11:30 Separated meeting within each Working Group to discuss protocols, results, strategies.
11:30 – 12:30 Plenary session
12:30 – 13:30 Lunch
13:30-19:30 Practical demonstration provided by each WG (e.g. data loggers application, brood removal techniques, evaluation of colony strength, powder sugar methods)
20:00 -21:00 Dinner
21:00 -22:00 Task-force general conclusions and WG presentations of conclusions and perspectives (WG1, WG2, WG4)