Why Treat for Varroa?

Buddy Marterre, MD
Possible reasons

- Because if I don’t I will lose all my bees
- So I can have 100 % overwinter survival
- The Varroa mites are worse than the treatment effects on the colony
- Fear
What are your goals?

- To be an expert in something
- Maximize honey production
- Help the environment
- Own an exotic pet
- Get out of the house
- Keep every colony alive
- Have something cool to talk about
- Spend more time with nature
- Having enough colony deaths to make nucs with the next spring
- Having enough honey money to buy some packages to replace your losses
Varroa destructor is like CANCER

- Original host is Apis cerana (Asian honey bee)
- Present in every single colony on the planet Earth
- Carries many viruses
- EXTREMELY VIRULENT PEST
- Will kill most colonies within 2 – 3 years if nothing is done
Be a good doctor

- Having Varroa in your colony is like *you* (personally) having cancer, but you – the beekeeper – are the doctor
- What would it be like to go to the doctor for cancer?
- What would you expect your doctor to know about the drugs he/she had to treat you with?
- Do you expect a 100 % cure with chemotherapy?
- Do you expect no side effects?
- What is marginal benefit of treatment?
  - The amount of benefit you receive over doing nothing
  - If you have a 70 % chance of survival with *no* treatment and a 80 % chance of survival *with* treatment, the marginal benefit of treatment is 10 %
Varroa chemical treatment studies

- All varroicides have been tested for their ability to kill Varroa mites
- Lethal effects on adult bees have been tested for all
- A few sublethal effects have been studied
- Synergistic effects on bees are just now beginning to be addressed
- No randomized controlled field trials have ever been published on overwinter survival
Varroicides are like chemotherapy

- All are lipophilic and collect in beeswax
  - This is where the brood is reared!
- Every varroicide is poisonous to bees too
- Some strains of Varroa mites have developed resistance to Fluvalinate and Coumaphos
Matching Question

- Coumaphos
- Fluvalinate
- Amitraz
- Thymol-based essential oil products
- Organic acids (Formic)

- Organophosphate; worst effects on the environment
- Worst ‘synergist’; has serious sublethal activity
- Quite safe but breakdown products are very unsafe
- The lowest selectivity ratio (LD50 mite / LD50 bee)
- Bees ‘dislike’ the most
‘Hard’ chemicals in foundation

- 98% of 259 comb and foundation wax samples contained:
  - Fluvalinate (up to 204 ppm)
  - Coumaphos (up to 94 ppm)
    - C Mullin, PLoS ONE 5(3): e9754
- Queen acceptance and weight decrease at a queen cell wax concentration between 10 and 100 ppm of coumaphos
  - J Pettis, Apidologie, 2004
- Frame 1 coumaphos concentration 256 ppm after a single treatment on frame 5!
  - J Berry, Bee Culture, 2009
- Fluvalinate has sublethal (weight and sperm number) and coumaphos has lethal effects on queen rearing
  - Haarmann, J Econ Entomol, 2002
- Plastic foundation alters vibrational signaling (and heat transfer), comb building AND honey production
  - T Seeley, Apidologie, 2005; ABJ, 2006
- No drone sized cells (17% feral)
- Bees pull it ‘wrong’
‘Soft’ chemical effects

- Formic acid reduces adult drone survival, worker longevity, and brood survival
  - de Guzman, ABJ, 1999
  - Fries, ABJ, 1991
  - Underwood, Exp Entomol Acarol, 2003
- Thymol induces brood removal and decreases sperm viability
  - Floris, J Econ Entomol, 2004
  - Burley, VT Masters, 2007
- Organic acids and essential oils have strong odors and really disrupt honey bee colonies during (and probably after) treatments
To treat (w/ chemicals) or not to treat...

- Resistant strains of mites are selected by over-treatment because unnecessary drug exposure favors their survival over non-resistant strains.

- Varroa mites reproduce faster in managed colonies than in feral ‘survivor’ colonies.

- Seeley TD, Honey Bees of the Arnot Forest..., Apidologie, 2007
NO chemicals? Slower reproducing mites

Figure 1. Average mite population size (log10-transformed) over the season, in Bond (N = 12) and Control queen colonies (N = 15). The differ-

Fries and Bommarco, Possible host-parasite adaptations..., Apidologie, 2007
# my over-wintering experience

<table>
<thead>
<tr>
<th>Winter</th>
<th># of Fall Hives</th>
<th># Spring Hives</th>
<th>Over-Winter Survival</th>
<th># Treated for Varroa</th>
<th>Pollen In Fall</th>
<th>Varroa Treatment</th>
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</thead>
<tbody>
<tr>
<td>03 - 04</td>
<td>3</td>
<td>3</td>
<td>100 %</td>
<td>3</td>
<td>no</td>
<td>Thymol</td>
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<tr>
<td>04 - 05</td>
<td>5</td>
<td>5</td>
<td>100 %</td>
<td>2</td>
<td>no</td>
<td>ApiLife Var</td>
</tr>
<tr>
<td>05 - 06</td>
<td>8</td>
<td>5</td>
<td>63 %</td>
<td>5</td>
<td>no</td>
<td>Apistan</td>
</tr>
<tr>
<td>06 - 07</td>
<td>11</td>
<td>11</td>
<td>100 %</td>
<td>4</td>
<td>yes</td>
<td>ApiLife VAR</td>
</tr>
<tr>
<td>07 - 08</td>
<td>14</td>
<td>11</td>
<td>79 %</td>
<td>0</td>
<td>yes</td>
<td>NONE</td>
</tr>
<tr>
<td>08 - 09</td>
<td>12</td>
<td>8</td>
<td>67 %</td>
<td>0</td>
<td>yes</td>
<td>NONE</td>
</tr>
<tr>
<td>09 - 10</td>
<td>14</td>
<td>4</td>
<td>29 %</td>
<td>0</td>
<td>no</td>
<td>NONE</td>
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<tr>
<td>10 - 11</td>
<td>14</td>
<td>12</td>
<td>86 %</td>
<td>0</td>
<td>yes</td>
<td>NONE</td>
</tr>
<tr>
<td>11 - 12</td>
<td>11</td>
<td>8</td>
<td>73 %</td>
<td>0</td>
<td>yes</td>
<td>NONE</td>
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<tr>
<td>12 - 13</td>
<td>5</td>
<td>3</td>
<td>60 %</td>
<td>0</td>
<td>yes</td>
<td>NONE</td>
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</tbody>
</table>
My raw data

- 12/14 treated colonies survived
  - 86 %

- 58/82 untreated colonies survived
  - 71 %

- Marginal benefit 15 %?
results by *intention* to treat

<table>
<thead>
<tr>
<th></th>
<th># of Fall Hives</th>
<th># Spring Hives</th>
<th>Over-Winter Survival</th>
<th># Treated for Varroa</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>97</td>
<td>70</td>
<td>72 %</td>
<td></td>
</tr>
<tr>
<td>selectively to treat</td>
<td>27</td>
<td>24</td>
<td>89 %</td>
<td>14/27</td>
</tr>
<tr>
<td>not to treat but pollen</td>
<td>63</td>
<td>49</td>
<td>78 %</td>
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</tbody>
</table>
Bee Informed survival (’10 – ’11)

- Any treatment used 70.5 % survival
- No treatment used 63.3 % survival
  - Marginal benefit 7 %?

- NO-treatment philosophy (3,590)
  - 66.4 % survival 1 % beekeepers

- Mostly natural-treatment philosophy (92,919)
  - 66.6 % survival 35 % beekeepers

- Any-treatment philosophy (171,594)
  - 64.3 % survival 64 % beekeepers
treatment risk vs. benefit

**BENEFIT**
- Spend less time
- Marginal survival benefit of *perhaps* 7 – 15%
  - No randomized field trial of overwinter survival has ever been published on any varroicide!

**RISKS**
- Weaker bees
- Stronger mites
- Poisoned wax
- Harmed environment
- Spend more money
- Spend less time
what if you *have to* treat for Varroa?

- Sugar shake tests in the summer AND after treatments
- Don’t treat every hive indiscriminately
- Don’t treat for too long (> 3 to 4 weeks)
- Alternate between Formic Acid and Thymol (ApiLife VAR, ApiGuard) treatment every other year in the summer ONLY if the threshold is reached
- Use HopGuard in broodless period
- Don’t treat severely infested colonies - Just let them perish!
natural varroa mite strategies

- VSH, Minnesota Hygienic, Russian, and ‘Survivor’ queens
- Screened bottom boards
- Sunshine
- Drone brood trapping / removal
- Dowda method of powdered sugar dusting

**MAKING SPLITS AND REARING QUEENS**

- Splits the mites
- Rear queens from the survivors (tolerant)
- Keeps the mites ‘nicer’ than treatments
making a reverse split

In the Summer, after the honey flow
Transfer the queen!

original donor colony

→

nuc
OLD Queen
No capped brood

+ 

rearranged original colony
Rears the New queen
Has all the capped brood
Advantages of summer reverse splits

- **Varroa exposed**
  - Majority of Varroa left in strong colony which undergoes a brood cycle interruption and can be treated once

- **No damage from SHBs**
  - Small nuc is queenright, queenless colony strong

- **Lower robbing risk**
  - (Mostly) feed strong queenless colony

- **Improved overwinter survival**
  - Established queen more likely to survive in nuc

- **Lower swarm potential the following spring**
  - Strong colony has young queen
  - Old queen allowed to re-expand into new hive
### NO capped brood for 5+ days

<table>
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<tr>
<th>Age</th>
<th>Queen Stage</th>
<th>Age</th>
<th>Drone Brood Stage</th>
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<tbody>
<tr>
<td>0</td>
<td>Egg Layed (to become new Q)</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>* Split Day</td>
<td>0</td>
<td>Last Drone Egg Layed by Old Queen</td>
</tr>
<tr>
<td>7</td>
<td>* Cut Capped Queen Cells</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>New Queen Emerges</td>
<td>16</td>
<td>Last Old Q’s Drone Brood Emerges</td>
</tr>
<tr>
<td>4</td>
<td>Earliest Virgin Queen Mating</td>
<td>7</td>
<td>First New Queen’s Brood Capped</td>
</tr>
<tr>
<td>7</td>
<td>New Queen Starts Laying Eggs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>* Check For Egg-Laying Queen</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>New Queen’s Brood Capped</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>~21</td>
<td>* Cut Supercedure Cells</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 24/0: Last Old Q’s Drone Brood Emerges
- 6: First New Queen’s Brood Capped
- 16/0: New Queen Emerges
- 10: * Check For Egg-Laying Queen
- 7: * Cut Capped Queen Cells
- 4: Earliest Virgin Queen Mating
- 7: New Queen Starts Laying Eggs
- 0: Last Drone Egg Layed by Old Queen
- 0: Egg Layed (to become new Q)
- 2: * Split Day
- ~21: * Cut Supercedure Cells
- 0: No capped brood for 5+ days