EFFECT OF FLUMETHRINE
ON VARROA DESTROYER IN HONEYBEE COLONIES

NADIR ALLOUI, MOHAMED REDHA BOUCHERIT
AND FERHAT NOUICER

Veterinary Department,
University of Batna, 05000 Batna, Algeria
e-mail: alloui@lycos.com

It was demonstrated that flumethrine administered in a simple manner in hives proved
to be efficient, non-harmful compound in the treatment of varrosis in honeybees.

Key words: honeybee, Varroa destructor, chemotherapy, flumethrine.

The apiculture is an important factor in the Algerian agricultural development,
in particular in the crossing pollination of numerous plants, cultivated or natural, and in
the honey production. Installation of honeybee colonies increases and improves the
plant production, but is also indispensable to the maintenance of the natural balance on
earth. Honeybee constitutes a very important ecological index of the environment. But
like all animals, honeybee can be affected by various diseases.

One of the main illnesses that provoke big losses in apiculture in Algeria is
varrosis (1). The etiologic factor is a parasitic mite Varroa destructor (7). Because of
economic losses caused by this disease, and in order to find solution to this serious
problem, we performed a chemotherapy test using flumethrine in the infested honeybee
colonies.

Material and Methods

The experiment has been done in apiary Eucalyptus belonging to the
Apiculture Department of the Constantine University consisting of eight hives with
swarms introduced in 1995 and 1996. The race of the bee in this apiary is Apis mellifica
intermissa. The treatment with flumethrine (Bayvarol®) in a dose of 3.6 mg per 1strip
was carried out from the 3rd till the 14th of November 1998, whereas examination was
performed after the treatment on the 27th of April 1999.

Diagnosis of varrosis. It was performed on appropriate number between 100
and 400 of adult honeybees from several settings of every hive, set down into a globe.
Then, we poured in a solution of 70-80° alcohol. After some minutes, when bees died,
we agitated the container so that all Varroa mites could be detached from their hosts.
We collected bees and count them to verify that no parasite remained fixed on
honeybees. At the end of the experiment we count also the dead insects remained on the globe bottom. We calculated the infestation rate by the following formula (20).

\[
\frac{N_v \times 100}{N_a} = T_x
\]

\(N_v\) - number of varroas; \(N_a\) - number of honeybees; \(T_x\) - infestation rate

**Method of treatment.** In our experiment we put down four thongs of flumethrine in every hive, then we slipped greased diapers under settings of hives. We let the product to act and removed diapers two times per week (with 3 to 4 d of interval). At the end of each operation we counted the number of bees that had fallen onto the grease (10, 11, 13, 14).

**Results**

**Results before treatment.** Infestation rate of honeybee colonies infected with varroas is presented in Table 1.

We noted that hives 5 and 8 were weakly occupied by parasites and presented a limited rate of infestation of 3.12 and 4.30%, however, the hives 3, 6 and 7 presented a rate of infestation between 10 and 15%. Macroscopic examination showed malformed larva of bees and after opening some cells of the incubator, we noted the presence of many immature varroas in the bees’ pulps. The hives 1, 2, and 10 were seriously infested with a rate between 20 and 28%.

<table>
<thead>
<tr>
<th>Hive</th>
<th>Number of varroas</th>
<th>Number of bees</th>
<th>Infestation rate %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26</td>
<td>125</td>
<td>20.80</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>93</td>
<td>25.81</td>
</tr>
<tr>
<td>3</td>
<td>09</td>
<td>90</td>
<td>10.00</td>
</tr>
<tr>
<td>5</td>
<td>03</td>
<td>96</td>
<td>3.12</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>119</td>
<td>11.76</td>
</tr>
<tr>
<td>7</td>
<td>18</td>
<td>127</td>
<td>14.17</td>
</tr>
<tr>
<td>8</td>
<td>04</td>
<td>93</td>
<td>4.30</td>
</tr>
<tr>
<td>10</td>
<td>33</td>
<td>122</td>
<td>27.05</td>
</tr>
<tr>
<td>Total</td>
<td>131</td>
<td>865</td>
<td>15.14</td>
</tr>
</tbody>
</table>

**Results during treatment.** Results of examination during treatment are summarized in Table 2. During the six weeks of treatment we noted a significant fall of varroas since the first week. The number of parasites decreased quickly during the first three weeks in the hive 1 from 640 to 39, in the hive 2 from 477 to 25, in the hive 6 from 779 to 17 and in the hive 10 from 929 to 39.
During the fifth week we observed a light increase in the number of parasites in the hives 1, 5 and 8. This increase resulted from the birth of some operculated bees or from a certain number of varroas which escaped flumethrine. At the end of the sixth week the number of varroas has really decreased since it varied between 2 and 8 parasites for all hives. During the treatment the number of honeybees killed was relatively small and remained in the limits enabling survival of the colony. This mortality resulted from the strong manipulation with diapers which caused the bruising of several bees.

Table 2
Number of varroas harvested during a treatment

<table>
<thead>
<tr>
<th>Hive</th>
<th>Week I</th>
<th>Week II</th>
<th>Week III</th>
<th>Week IV</th>
<th>Week V</th>
<th>Week VI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>640</td>
<td>578</td>
<td>39</td>
<td>19</td>
<td>32</td>
<td>07</td>
</tr>
<tr>
<td>2</td>
<td>477</td>
<td>459</td>
<td>25</td>
<td>11</td>
<td>14</td>
<td>08</td>
</tr>
<tr>
<td>3</td>
<td>433</td>
<td>189</td>
<td>29</td>
<td>16</td>
<td>05</td>
<td>03</td>
</tr>
<tr>
<td>5</td>
<td>235</td>
<td>228</td>
<td>08</td>
<td>16</td>
<td>45</td>
<td>02</td>
</tr>
<tr>
<td>6</td>
<td>779</td>
<td>226</td>
<td>17</td>
<td>08</td>
<td>06</td>
<td>05</td>
</tr>
<tr>
<td>7</td>
<td>592</td>
<td>308</td>
<td>75</td>
<td>20</td>
<td>20</td>
<td>06</td>
</tr>
<tr>
<td>8</td>
<td>381</td>
<td>203</td>
<td>44</td>
<td>11</td>
<td>11</td>
<td>05</td>
</tr>
<tr>
<td>10</td>
<td>929</td>
<td>374</td>
<td>39</td>
<td>12</td>
<td>11</td>
<td>04</td>
</tr>
</tbody>
</table>

Results after treatment. The results after the treatment are presented in Table 3. It shows the different rates of infestation in hives. We noted the death of the colony 3, caused by the winter that was very rough during this period. However, the death of the colony 10 was caused by the massive infestation with the Varroa in this hive (27.05% in Table 1) and even the treatment did not save this colony.

The rate of infestation in colonies 1, 2, 5, 6, and 8 equaled zero except the one hive 7 (0.89%). The mean of infestation of the entire apiary is 0.13%.

Table 3
Infestation rate of honeybee colonies after the treatment

<table>
<thead>
<tr>
<th>Hive</th>
<th>Number of varroas</th>
<th>Number of bees</th>
<th>Infestation rate %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>85</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>263</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>109</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>104</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>112</td>
<td>0.89</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>122</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>795</td>
<td>0.13</td>
</tr>
</tbody>
</table>
Discussion

In Algeria, varroasis was observed in 1981 (1). Since then several outbreaks have been discovered on all the territory. The struggle against this disease permitted the use of natural products, chemical products and innovative techniques (4, 6, 9, 16, 17). Chemical acaricides (phenothiazine, amitraz, nitrobenzene, fluvalinate, coumaphos and acrinathrine) have been applied but unfortunately a chemical resistance of the parasite has been observed (2, 5, 8, 21). Several authors now recommend the triennial therapy (15, 21). Faucon et al. (8) had noted the efficient reduction of varroas by the use of fluvalinate; in the same way they showed the parasitic resistance to acaricides by the determination method of the mean lethal time. Wallner (22) demonstrated that flumethrine accumulates easily in wax and passes into the honey.

Some physical methods were also used in varroasis control, such as thermotherapy, when bees were treated with heat up to the beginning of their perishing, which comes at about 45°C after 22 min, at 46°C after 16 min, at 47°C already after 6 min. Efficiency of thermotherapy was nearly 98% (12).

Biological method (19) was verified in varroasis control, using wild mites *Chelyetus eruditus*, but these did not found suitable conditions in hive space to kill varroas.

Phytotherapy was used in varroasis control using the following plants (3, 18): garlic (*Allium sativum*), tobacco (*Nicotiana tabacum*), walnut (*Juglans regia*), tomato (*Lycopersicon esculentum*), wormwood (*Artemisia absinthium*), pine (*Pinus sylvestris*), tansey (*Tanacetum vulgare*) and others. The 50 up to 80% efficiency using these plants was attained when their extracts were applied 2-3 times a week, when the bottom of the hive was covered with paper with a layer of sticky substances (vaseline, oil) and wire mesh.

Flumethrine administered in hives in a very simple manner, is very efficient and also non-harmful for the honeybee. However, it is necessary to wait for the next years to verify if a chemical resistance to this product exists or not. The use of synthetic molecules in the struggle against varroasis shows its limits, and then it seems very important to make researches on the biology of the mite to inhibit their reproduction, e.g. prevent female *Varroa* to lay eggs, to make the *Varroa* male sterile.

References