Survival of honey bees during winter in colonies infested by *Varroa destructor*

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Introduction

When honey bee brood is infested by *Varroa destructor* mites the bees have a shorter lifespan. Especially for winter bees this is of great importance. To ensure healthy winter bees Varroa has to be controlled before winter bees are produced.
The objective of this research is to determine when most winter bees are produced in the Netherlands and to what extend different periods of Varroa control in autumn affects survival of winter bees.

Methods

In 2005 between August 10 and November 2 every two weeks freshly hatched grey bees were marked and the sealed brood area was measured. From this the amount of bees hatching in this period was estimated. The survival of the marked bees was counted every two weeks till November 2 and after winter on April 19. Mite fall was counted every week.
The differences between the treatments (mite infection pressure in July and date of Varroa treatment) is shown in Table 1. Each treatment contained 6 colonies. All colonies were treated with oxalic acid in December.

Table 1. Winter survival of bee colonies under different Varroa pressure

	treatment		result		
treatment number	daily mite fall in July	date Thymovar treatment (3 weeks)	survival of colonies over winter (%)	mean # of winter bees per colony on April 19	mean # of bees per colony on April 19
1	3	no	100	1814	7200
2	18	Aug 10-Sep 5	100	1279	6300
3	17	Sept 8-Sep30	100	1269	5800
4	18	no	33	369	4000

Results

The winter 2005/2006 was not representative for Dutch winters. Autumn was very warm, till end of October and spring was very cold, till April. The first major cleansing flight was seen on March 20 when temperature was above 12°C for the first time that year. Therefore, the experiment will be repeated next winter. Results are shown in table 1 and figures 1 to 3.

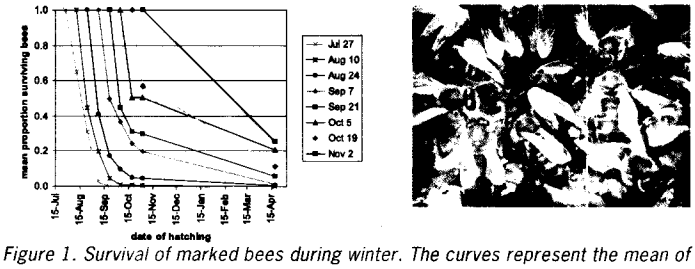

Figure 1. Survival of marked bees during winter. The curves represent the mean of colonies from all treatments. Between November 2 and April 19 actual counts of marked bees were suspended due to cold temperatures and dense clustering.

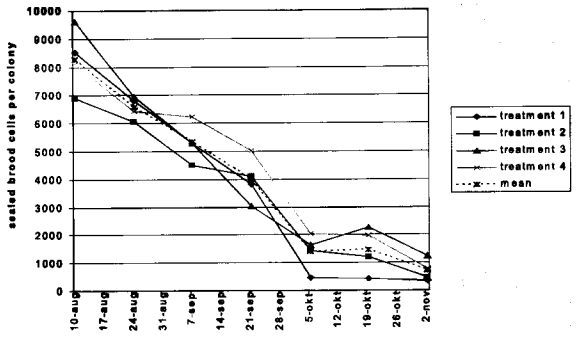

Figure 2. Course of brood present in bee colonies under different Varroa pressure. Differences between treatments are shown in table 1.

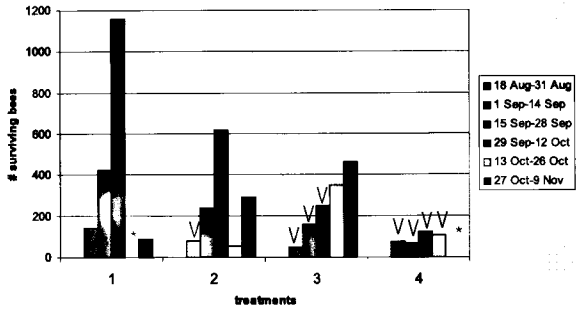

*Figure 3. Survival on April 19 of bees hatched on different days (calculated: the portion of marked bees X amount of bees hatched in that period). Differences between treatments are shown in table 1. When bars are marked "V" the colonies were highly infested with mites during the period that mites could invade the brood cells of these bees. *=missing value: no bees were marked in treatment 1, no marked colonies survived in treatment 4.*

Conclusions

- In healthy colonies most winter bees surviving till spring are produced between half September till half October, in Varroa infected colonies this is later.
- When colonies are infested with Varroa mites till late in autumn (treatment 3 and 4) they produce a higher amount of brood for a longer period (fig 2).
- Only few bees hatching from infested colonies survive winter, resulting in a low amount of bees in spring and colony loss of 67% of the colonies that had no Varroa control (table 1, fig 3) .
- It is clear that only after the Varroa population is diminished the colonies produce bees that survive well over winter.
- In treatment 2 and 3 more bees survive from the second cohort than from the first cohort after the Varroa population is diminished. This might be due to the fact that the bees nursing the young bees are still suffering from the effect of Varroa infestation.

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