

A NEW TYPE OF FORMIC ACID DISPENSER FOR VARROA MITE CONTROL

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Abstract

Several formic acid dispensers for varroa mite control have been already designed. However, since the evaporation rate is temperature dependant, most of the existing dispensers need the manual settings of the evaporation rate.

In this work the design of a new type of passive formic acid dispenser with practically constant evaporation rate in the temperature range from 13 to 35°C is presented. Such characteristic of the dispenser has been achieved using the proper relation between the wick and the evaporation surface resistances.

The field testing has been carried out in the diverse climatic regions of the Slovenia during the July and September in the time intervals of 7 and 10 days respectively.

By initial testing of the varroa mite control efficiency in 210 AŽ and 7 LR beehives an average efficiency of 90,5 % was achieved.

Introduction

The formic acid has been already used for the varroa-mite control from the very beginning, when the varroa appears in our beehives. But it turned out very soon, that the use of formic acid requires reliable evaporation rate control, if the sufficient varroa control should be achieved, regarding the weather influence on evaporation rate. The essential weather parameters which have influence on evaporation rate are the air temperature and the air relative humidity.

Several formic acid dispensers have been designed so far and many important improvements done, however, most of them still require manual settings. This fact is probably the one of the most important reason that the use of formic acid for varroa control is not so widely spread in the beekeeping as it should and possibly could be.

In this work the design of a new type of passive formic acid dispenser which automatically regulates the evaporation rate to the tolerable value in the temperature range from 13 to 35°C is presented.

Materials and Methods

In the initial part of our study we determined several starting-points which should be taken in to the account at the construction of a formic acid dispenser:

- The evaporation element could theoretically not be at the same time also the control element which determines practically constant evaporation rate at changeable weather conditions.
- The regulation of the evaporation rate must be performed with the separate element placed between the reservoir of formic acid and the evaporation element.
- The formic acid concentration rise in time, at the start of the treatment, and it should be long enough to guarantee the safe operation for the bees and beekeepers.

The principal construction of the new BS-05 dispenser which fulfils the above mentioned requirements is shown on the Figure 1.

For the dispenser characteristics measurement purposes, the experimental chamber, a heat isolated box with an internal heater, a temperature control element and a ventilator, was used. The air circulation rate in the box is about 15 m³ h⁻¹. The relative humidity in the chamber is controlled using the water solution of sodium hydroxide. Two essential characteristics of the dispenser have been measured in the experimental chamber:

The concentration rise time at the start of evaporation

The released formic acid per day as a function of temperature.

The field testing of the BS-05 dispensers was carried out in the year 2002 from 25 July to 10 August in the 200 AŽ and 7 LR hives on diverse climatic locations.

During that time, the maximal day temperature varied between 17 and 32°C.

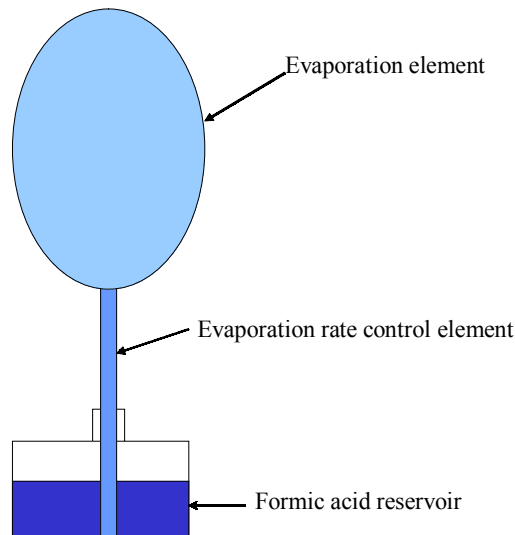


Figure 1 - The basic drawing of the dispenser BS-05

Results

The concentration rise time at the start of the dispenser operation is shown in Fig. 2. From the diagram we can see, that the first minor concentration of formic acid begin to appear not earlier then half an hour after putting the dispenser in operation, and reach the final operational concentration (0.3 g / m³) after 24 hours. Such starting characteristic of the BS-05 dispenser enables the accommodation of bees to acid vapour, preventing stress situation to appear in the bee-colony.

Fig. 3 shows the formic acid evaporation rate as a function of the air temperature, obtained in the experimental chamber. We can see that in the temperature interval from 15 to 35 C, the amount of the evaporated formic acid per day change from about 13 g to 19 g without any manual setting of the dispenser.

During the field test carried out in the 11 apiaries on diverse climatic different locations, the daily evaporated formic acid varied between 13g and 18 g per day while the temperature varied from 17 to 32 C.

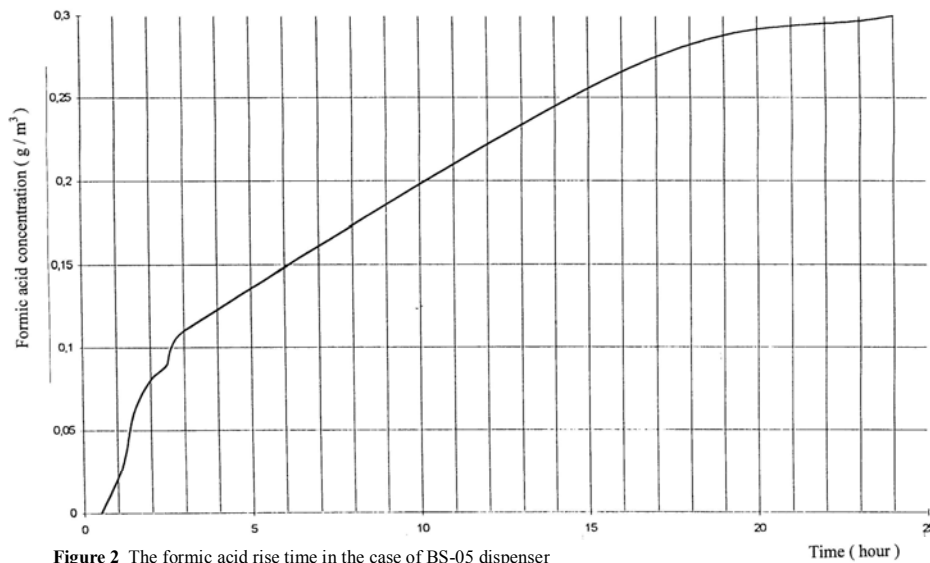


Figure 2 The formic acid rise time in the case of BS-05 dispenser

Figure 2 - The formic acid rise time in the case of BS-05 dispenser

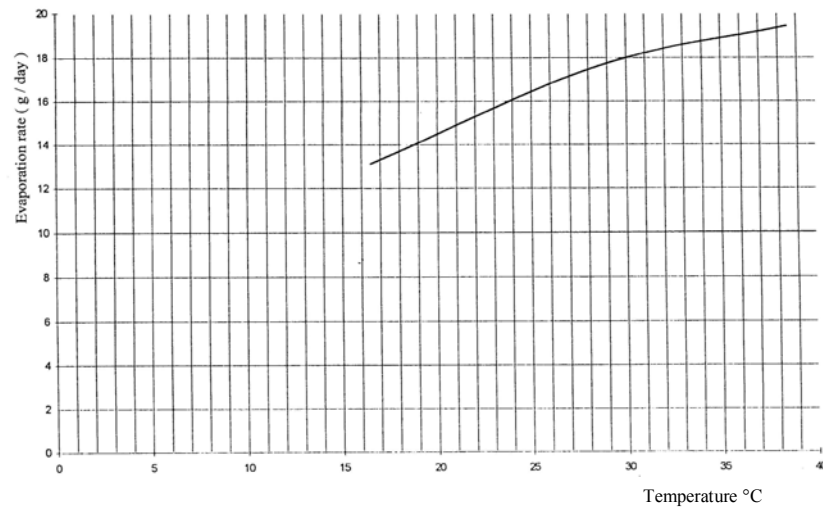


Figure 3 - The formic acid evaporation rate as the function of the temperature

Discussion

Laboratory and field testing of the new formic acid dispenser shows that the BS-05 dispenser fulfils all the essential requirements needed for successful implementation of the formic acid in varroa control. Beside the excellent characteristic, the new dispenser requires negligible labour during application and is very simple for use.

On the Fig. 4 we can see the installation of the dispenser BS-05 in a case of the AŽ hive. Our investigation has shown that in the case of our AŽ hive the dispenser can be simply fixed on the door of the hive and the required concentration of formic acid inside the bee colony is obtained.



Figure 4 - The BS-05 dispenser in the AŽ hive

On the Fig. 5 the installation of the BS-05 dispenser in the LR hive is shown.



Figure 5 - The BS-05 dispenser in the LR hive

It can be concluded that the BS-05 dispenser is of very simple construction , has a characteristics which enable safe and efficient application and minor work because there is no need for surveying weather prognosis and subsequent manual settings of the dispenser.