

# Course in Determination of Colony Strength

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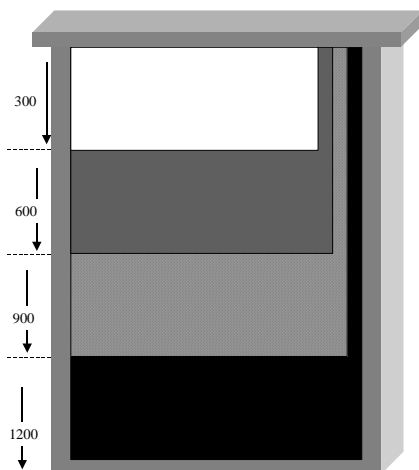
*How many bees do actually live in a hive ? Is the culmination number of a colony 30'000 or 60'000 bees? What is the number of bees in a strong colony at the beginning and at the end of wintering ? When does the rate of brood rearing reach the maximum? How many worker bees and drones are reared during the whole bee season ? What is the effect of stimulative feeding on the development of a colony? In order to answer these questions exactly, the bees of a colony are brushed into a swarm box and their weight is determined. Then the average weight of a bee is determined by weighing approximately one hundred bees. Based on these two weights the colony strength can be calculated relatively exactly. For determination of the open and the sealed brood the surface of each comb side has to be transferred onto a foil and measured planimetrically. If the colony development during the bee season has to be controlled, these measurements should be repeated every 3 weeks which is the development period of worker bees. A lot of work is involved, if a great number of colonies has to be controlled in a trial. Therefore, a simpler method producing good and also reproduceable results has been developed.*

## **The Liebefeld Estimation Method**

In order to save time the number of bees as well as the open and the sealed brood surfaces on each comb side are estimated with this method. If the exact colony strength has to be determined, the estimation should be carried out early in the morning before the beginning of flight. However, in extensive investigations this is not possible. In that case it is sufficient to compare the averages of the groups tested. It is the relative comparison that matters not the absolute number. Constant flight conditions are of utmost importance. In order to compensate the fluctuations of the flying activity, only one colony should be estimated alternately in each trial group. Ideally, the estimation is carried out by two persons: an estimator and a secretary. The data are either written down on paper ( form see appendix) or typed directly on a handheld computer. These data can be administrated and evaluated by the software „PopDyn“ which can be ordered on payment at our address.

## **Estimating the number of bees**

A one-seam comb (Swiss type) occupied densely by bees contains approximately 1200 bees per comb side (including the frame), while a Dadant-Blatt comb side contains about 1400 bees ( other



comb types: see table). If the occupation is less dense and if less bees are spread all over the comb, these bees are moved together mentally in horizontal format of the comb. Then it is decided what part of the comb will be covered on the scheme to the left by this strip of bees. According to this scheme the actual number of bees on the combs can be estimated based on the numbers attributed to the squares. One dm<sup>2</sup> occupied comb surface contains approximately 130 bees. However, if all the bees put their heads into the cells, their number can be up to 400. This possibility has to be considered for the estimation. Depending on season and colony about 500 to 3000 bees remain on the walls of the hive. In this case the number of occupied surfaces in the size of a comb should be estimated. An average bee beard measuring 12 x 6 x 3 cm contains about 750 bees. In order

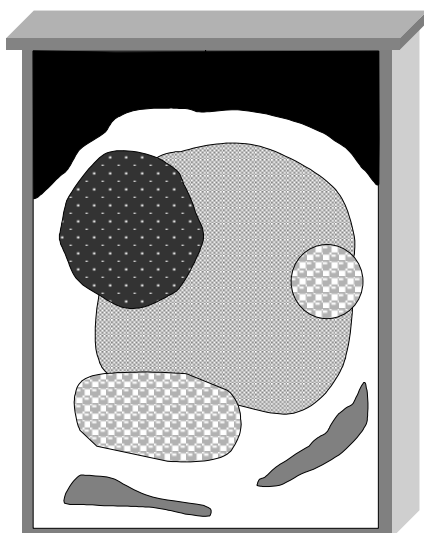
to carry out exact and reproducible estimations as rapidly as possible, it is recommended to compare the estimation results with the weight determination as described above: the bees are

brushed off and weighed immediately after estimation. This calibration is absolutely necessary for beginners.

**Guide values for estimation of bees on various comb types**

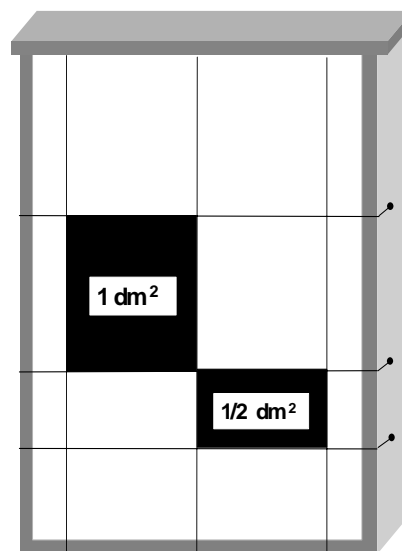
Comb type	Surface per side of brood comb dm <sup>2</sup>	Number of bees per occupied side of brood comb
Swiss	9.3	1200
Dadant	11.3	1400
German normal size	7.2	900
Langstroth	8.8	1100
Zander	8.1	1000

**Estimating the brood surface**



eggs } open brood  
 coiled larvae }  
 sealed brood }  
 pollen  
 stores  
 empty cells

After estimating the bees the sealed and then the open brood surface is estimated on the same comb (fig. left). A frame divided by nylon strings into squares measuring 1 dm<sup>2</sup> or a measuring tape can be used for the determination of both types of brood surfaces (fig. below right). By means of the frame the screen of the corresponding size is held on top of the brood areas which have to be estimated in such a way that they lie within the screen boundaries and cover the whole surface of the screen unit. Possibly several small and dispersed brood areas have to be added mentally to screen areas that are not completely filled. If the brood surface is interspersed with empty brood cells, the percentage of intact cells



per screen surface is estimated and the final number corrected. After sufficient practice these expedients can be abstained from. The beginning estimator has to “calibrate” himself by applying the surfaces of several colonies onto a foil, measuring planimetrically and then comparing with the estimation values.

**Procedure of estimation**

The colony is opened accompanied by a stroke of smoke. The bees are knocked off the window and/or the cover board. In Swiss hives comb after comb is estimated and placed in line into the frame holder. The bees on the hive walls are estimated before hanging the combs back into the hive. If all the combs in the Swiss hive are occupied, the number of bees and the brood surface on the first comb are estimated. Then this comb is placed beside the hive. After estimation the following combs are placed back into the hive by shifting one position to the left. Finally, the first

comb is placed into the remaining, empty position. In colonies of several storey hives the upper storeys are lifted off. The bottom storey is estimated first, then the following storey is placed on top of it and the estimation is continued in the same way.

### ***Precision of the Liebfeld estimation method***

The precision of this method has been checked with two colonies during the entire bee season of 1984. At intervals of three weeks the colonies were first estimated early in the morning before the beginning of flight. Then the bees were weighed and the brood surfaces measured planimetrically. The estimation results correlate very well with the measurements of the number of bees ( $r^2 = 0.967$ ,  $n = 18$ ) and of the sealed brood ( $r^2 = 0.987$ ). The estimation of the open brood correlates less with the measurements ( $r^2 = 0.654$ ). The total brood surface per colony during the trial period was over-estimated by 1.6% resp. 5.4%. The comparison showed that the number of bees was regularly under-estimated. Further estimations are corrected by increasing the reference value from 120 to 130 for the number of bees per  $\text{dm}^2$ . The following publication contains more information about this study:

Imdorf A. et al. 1987: Control of estimation method for the determination of brood surface and number of worker bees in free flying bee colonies. *Apidologie* 18 (2) 137-146 (in German).

### ***A method valuable not only for scientists !***

Even beginners can acquire knowledge concerning the colony development by estimating two or three colonies at intervals of three weeks during a whole bee season. No book can convey such knowledge. This method yields the basis for suitable bee keeping and for successful hive management.

*Translation: Barbara Bogdanov*

*After Gerig L. (1983) Lehrgang zur Erfassung der Volksstärke. Schweiz. Bienen-Zeitung 106 (4) 1099-204.*

## Estimation protocol

Beekeeper		Apiary				Date		
Observations							Colony	
	Brood chamber			Honey chamber				
	Bees	Sealed brood	Open brood	Bees	Sealed brood	Open brood	Drone brood	Observations
Comb 1								
a								
1 b								
2 a								
2 b								
3 a								
3 b								
4 a								
4 b								
5 a								
5 b								
6 a								
6 b								
7 a								
7 b								
8 a								
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12 a								
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13 b								
Hive								
<b>Total</b>				←	←	←		