

bees Physics

Looking for the good climate Stock

Bernhard Heuvel, October 2013

basic data

prey

When calculated here prey is a Warrébeute with two frames (usual wintering configuration) with a metal lid, inner lid, two sides and an open bottom. Between outer and inner cover an insulation is mounted.

The dimensions of the inside of a frame is 30 x 30 x 20 cm (W x D x H). The wood of the side wall is 2.5 cm thick.

The following heat transfer coefficient ($W / (m^2 * K)$) of the spoils parts were determined uwert.net using the tool.¹

	<i>U-value, Φ W / (m² * K</i>	<i>A surface in m²</i>
Φ roof	0.69	0.09
Φ Side walls without / with insulation	0.44 / 59.62	0.48
Φ Bottom (open)	2.21	0.09
Total inward: 0.66 m ²		

bees

The Bien has a Continuous thermal output of 20 W. (20 Ws / J) This corresponds 0.00000555556 kWh. Each second, one single bee consumed 0.000000018 kWh to come to 40 ° C.²Theoretically, only 308 bees for 20 watts power required - to be replaced, of course, but.

climate

For the summer 26 ° C [299 Kelvin] outside temperature and for the winter 10 ° C [263 K]. Outside temperature taken as a basis of calculation. To simplify 100% rel. Humidity of the outdoor air was adopted. The carbon dioxide of the outside air is assumed to be 0.55 g / kg tr. Air.

As a working model of the subsequent calculations served the instructions "*Calculating and planning materials for the air in enclosed barns*" the Working Group for electricity use in Agriculture³

¹<http://www.uwert.net>

²http://www.hobos.de/fileadmin/Presse/greenfacts_Honigbiene.pdf

³<http://www.aelonline.de/inhalt/fachinfo/download/heft17.pdf>

heat balance

Ideally, the heat balance of the hive is compensated - by the bees produced and supplied (in the permanent heat output) heat flow is equal to the dissipated to the surroundings of the hive heat flow.

$$\Phi_{to} = \Phi_{from} \quad \text{Ideally, a balanced heat balance.}$$

Means: In a continuous heating of Bees of 20 watts of heat dissipated power is also 20 watts.

Everything beyond this would mean an increased heating power and thus force the Bees. Higher consumption of stored winter food is also associated.

The beehive is unheated - the bees are the only source of heat. Therefore:

$$\Phi_{to} = \Phi_{Bees} = 20 \text{ W}$$

The dissipated heat flow goes in the beehive at least two routes vonstatten

- Once the ventilation (ventilation heat flow) and once on the envelope of the Beehive (transmission heat flow). Therefore:

$$\Phi_{from} = \Phi_L + \Phi_T$$

Whereby the total transmission heat flow from the partial transmission heat flows through the enveloping surface, consisting of cover, side walls and floor composed.

$$\Phi_T = \Phi_{cover} + \Phi_{side\ walls} + \Phi_{ground}$$

Say: The heat does one go about and lost exhaled air and on the walls.

Calculation of ventilation heat stream in winter

As required by the above instructions, the water vapor and carbon dioxide balance sheet are used to calculate the mass air flow for the hive. The larger value of the two calculations (water vapor vs. carbon dioxide) is then included in the calculation of the ventilation heat flow.

Air mass flow to steam balance

Amazingly, was found in a first research no literature that could provide information on the amount of ejected from the winter cluster of water vapor. So not much other choice than to derive the resulting water vapor itself. Here consumption of winter fodder per hour was measured at 10 ° C outside temperature $\delta_{aeWinter-used}$, which lies at 5.76 g / h. The auxiliary calculation to be found at the bottom. Circa 20% of winter fodder consists of water, which must leave the stuck at 10 ° C outside temperature winter cluster after metabolism.

$$\dot{X}_{\text{Bien}} = 5.76 \text{ G/H} * 0.2 = 1.152 \text{ G/H}$$

According to the manual, the air mass flow is calculated according to water vapor balance by the steam mass flow of Bien by the value of the subtraction of water vapor in the air Stock x_i and the water vapor content of the outside air x_a , (In g / kg tr. Air.)

Air mass flow to steam balance

$$\dot{m}_x = \frac{\dot{X}_{\text{Bien}} 1.152 \text{ G/H}}{x_i 29.64 - x_a 1.62 \text{ G/kg tr. air}} = \frac{1.152 \text{ G /H}}{28.02 \text{ G /kg tr. air}} \approx 0.041113 \text{ kg tr. air/H}$$

The values x_i and x_a are taken from 13 of the instructions of the table. The value of x_i was multiplied by 0.8, as in the beehive 80% rel. Humidity are accepted, the value from the table is valid for 100% rel. Humidity. From 37.05 g / kg tr. Air (at 35 ° C) were 29.64.

The calculated air mass flow to steam balance of 0.041113 kg tr. Air / hr corresponds to a required ventilation of about 31 liters per hour.

The volume is calculated by the calculated mass air flow is divided by the density of air at 10 ° C, the m^3 per table at 1.32 kg /. This results in the following volumes:

$$\dot{V} = \frac{0.041113 \text{ kg tr. air/H}}{1.32 \text{ kg /m}^3} \approx 0.031146 \text{ m}^3/\text{H} \approx 31 \text{ liter/H}$$

According to the guidance, the calculated value is smaller as expected, as it requires the other for air pollution typically priced air change factor of 1.83. A WarréBeute with two sides has about 36 liters total volume. The 1.8 to 3 times an air exchange rate would be expected, therefore 65108 liters per hour. (Where the total volume the honeycomb and bees must be subtracted.) This results in the steam mass flow of Bien: (in winter)

Air mass flow to carbon footprint

The second approach is through the carbon footprint. Luckily, the CO₂ known charge a bee at rest from studies and 5.4 nanoliters is indicated.⁴ This gives 324 nl / min and 19.440 nl / h. Assuming a winter cluster of 10,000 bees here results in an hourly output of 0.1944 l / h. Since 1 liter CO₂ weighs 1.96 g, a mass of 0.38102 g / h is exhaled.

The formula was then occupied by this value. The outside air has a fixed value for the carbon dioxide content and the allowable content of the house air can be valid only for the hive. Thus, the following calculation for the ...

Air mass flow to carbon footprint

$$\dot{m}_{KBeute} = \frac{0.38192 \text{ G} / \text{H}}{5.0-0.55 \text{ G/kg air}} = 0.38102 \text{ G/H} \cdot \frac{\text{G/kg air}}{4.45} \approx 0.08562 \text{ kg air/H}$$

From this, we calculate again the volume on the air density at 10 ° C or so on:

$$\dot{V} = \frac{0.0862 \text{ kg air/H}}{1.32 \text{ kg} / \text{m}^3} \approx 0.06486 \text{ m}^3/\text{H} \approx 65 \text{ Liters per hour}$$

With this value we get the requirement earlier asked for a change of air with a volume of 65108 liters per hour very close!

Since the value of the air mass flow is higher by carbon footprint, as the value of the air mass flow to steam balance, we use it for subsequent calculation of the ventilation heat flow.

Ventilation heat flow in winter

The ventilation heat flow is calculated by the above calculated air mass flow is multiplied by the specific heat capacity of dry air and the delta of the external and internal temperature in Kelvin. (308 K 263 K = 45 K)

Ventilation heat flow to air mass flow water vapor

$$\Phi_{Lwd} = 0.16445 \text{ kg tr. air/H} \cdot 0.28 \text{ Wh/K kg tr. Air} \cdot 45 \text{ K} \approx 2 \text{ W}$$

Ventilation heat flow to air mass flow of carbon dioxide

$$\Phi_{Lwd} = 0.08562 \text{ kg tr. air/H} \cdot 0.28 \text{ Wh/K kg tr. Air} \cdot 45 \text{ K} \approx 1 \text{ W}$$

The ventilation heat flow therefore calls from Bien a power of 1-2 watts at an outside temperature of -10 ° C.

⁴Respiration of resting honeybees, Helmut Kovac, a Anton Stabentheiner, a Stefan K. Hetz, b Markus Petz, a and Karl Crailsheim, J Insect Physiol. 2007 December; 53 (12): 1250-1261.

Calculation of the transmission heat stream in winter

The value of the transmission heat flow settles to the sum of the components of the prey that have specific thermal transmittance and surfaces. Here once the initial set table.

	<i>U-value, Φ W / (m² * K</i>	<i>A surface in m²</i>
Φ_{roof}	0.69	0.09
$\Phi_{\text{Side walls without / with insulation}}$	0.44 / 59.62	0.48
$\Phi_{\text{Bottom (open)}}$	2.21	0.09
Total inward: 0.66 m ²		

It is therefore necessary to calculate the partial transmission heat currents and then merge. Here, the thermal transmission coefficient is multiplied by the surface and the delta of the outside and internal temperature for each part. It is assumed that a winter outer temperature 10 ° C.

Calculation roof (insulated)

$$\Phi_{\text{roof}} = 0.69 \text{ W/ (m}^2\text{*K)} * 0.09 * 45 \text{ K} \approx 2.8 \text{ watt}$$

Calculation sidewalls (insulated)

$$\Phi_{\text{side walls}} = 0.44 \text{ W/ (m}^2\text{*K)} * 0.48 * 45 \text{ K} \approx 9.5 \text{ watt}$$

Calculation sidewalls (uninsulated)

$$\Phi_{\text{side walls}} = 2.76 \text{ W/ (m}^2\text{*K)} * 0.48 * 45 \text{ K} \approx 59.6 \text{ watt}$$

Calculating floor (high ground, open)

$$\Phi_{\text{ground}} = 2.21 \text{ W/ (m}^2\text{*K)} * 0.09 * 45 \text{ K} \approx 8.95 \text{ watt}$$

Overview Transmission heat flow

	<i>A surface in m²</i>	<i>watt</i>
Φ_{roof}	0.09	2.8
$\Phi_{\text{Side walls without / with insulation}}$	0.48	59.6 / 9.5
$\Phi_{\text{Bottom (open)}}$	0.09	8.95
total	0.66 m ²	21,25 Watt14,17

Already from the partial transmission heat flow shows that at 10 ° C, the comfort zone of Biens was abandoned because the total transmission heat flow with ~ 21 watts are already on the the next 20 watts of power. Especially when the side walls with the largest area remain uninsulated. Without insulation, a condensation on the insides of the prey is to be expected. Furthermore is shown that the open floor in spite of a comparatively small area of the Bien demanded of a high performance.

Total heat flow and heat balance consideration

After both ventilation heat flow and heat transmission power are fixed, they can be combined into an overall consideration. Outside temperatures calculated here for the case of winter cluster and at 10 ° C: again.

$$\Phi_{\text{beehive}} = \Phi_{\text{Tges}} 21,25W + \Phi_L 1.07 W = 22,32 \text{ watt}$$

The heat flow is at 22.32 watts so over the duration of the heating power Bien, it must do more work with this configuration and can - because lying about the duration of heat - probably not permanent. So here is rework, usefully via an insulation of the side surfaces and the bottom.

With non-insulated sidewalls of the total heat flow is just under 61 watts! Here the Bien has to apply three times the duration of heating. An additional burden for the Bien. As long as enough bees and enough honey are available and there are not too many days with less than 10 ° C, it will make it well - but at what cost ?!

Honey and heat

One milligram of honey contains 12.77 Joules. A Continuous thermal output of 20 watts means that 20 watts are made every second, or 20 watt-seconds or 20 Joule. That is about 1.6 mg or 0.0016 g of honey in every second that are required by this Bien. Well Noticed in an insulated prey and an outdoor temperature of 10 ° C.

0,0016g / second
0,096g / Minute
5,760g /
Stunde138g / day
967,68g / week
3.870g / month

At 10 ° C to 30 days, the bees would need continuous heating at 20 watts approximately 4 kg of honey / winter feed in the month. Fortunately, our winters are not as hard and the right cold frost days are limited to a few days or weeks.

At + 5 ° C, the temperature amplitude decreases external / internal and therefore the KZahl in the formula for the calculation of the transmission heat flows.

+ 5 ° C	A surface in m ²	watt
Φ _{roof}	0.09	1,863
Φ _{Side walls, with insulation}	0.48	6,336
Φ _{Bottom (open)}	0.09	5,967
total	0.66 m ²	14.17 watts

Feed consumption descends to these external temperatures (+ 5 ° C) ~ 2.9 kg per month. And at these temperatures, the Bien is also fully in the comfort zone (with insulation on the sides). Without insulation it must still afford ~ 40 watts.

And now?

The calculations clearly show that a reasonably executed insulation helps the bees going to stay in the comfort zone of their Continuous thermal output of 20 watts. Life instead survival.

Open are the questions of the right type of ventilation for me. How do I replace the calculated 65 liters of air per hour is the cheapest way? The open ground is a big hole in the amount of heat is lost, despite a comparatively small area to the total area for me. A steady but slow stream of air? Cross ventilation?

The wax honeycomb, bee help as a hot water bottle, because it represents a kind of latent heat storage.⁵ Anyone who has a finger inserted times in the feed ring in winter, know how warm the honey there is directly on the bees. But it will delay the flow of heat only and does not prevent it entirely. But what is good there as insulation or insulation?

Proper ventilation but who wants to be calculated. The next project!

⁵<http://de.wikipedia.org/wiki/Latentw%C3%A4rmespeicher>

Bees Physics, Part 2

Looking for the right hive Air

Bernhard Heuvel, October 2013

From the ventilation of the hive

Calculate the right size for the opening area

In the first part, we calculated the required air exchange mass of the hive, which is for Warrébeute with two frames at 65 liters per hour or 0,065 m³ / h. This corresponds to 1.8 times the volume of the loot inside Warré which equipped with 36 liters liegt. Mit this value, the question arises as to the correct dimensioning of the supply and exhaust port. (Entrance hole.) How large the cross section must be so that the above desired ventilation rate and volume is achieved without the air speed degenerates into the prey to draft and is the Bien unpleasant. In pig (pigs are very sensitive to a draft) for this purpose, a maximum value of 0.2 m / s is specified. For our example, we reduce by half: 0.1 m / s, because the bees will not be on the train. But the required volume of air to be moved. For the movement of the air, especially the inner thermal (heat of Bien) and the wind from the outside as a vehicle to Verfügung. Zur calculate the orifice area in square A_{to} is brought to the application the following formula:

$$A_{to} = \frac{\text{Airflow } m^3 / H}{\text{Air velocity } m / s * 3600 s / H}$$

Where the multiplication by 3600 s / h, the conversion of the air velocity on the hour (an hour has 3600 seconds.)

$$A_{to} = \frac{0,065 m^3 / H}{0.1 m/s * 3600 s / H} = 0.00018 m^2$$

The calculation results in a required for the supply air opening area of **1.8 cm²**, Is the opening area of a circular area, then the diameter calculated as follows:

$$\text{diameter}_{\text{circle}} = \sqrt{\frac{1.8 cm^2}{\pi}} * 2 = \sqrt{\frac{1.8 cm^2}{3.14159}} * 2 = 0.75693461 cm * 2 = 1.4 cm$$

The ZuluftÖffnungsfläche is already served by a circular hole diameter of 1.4 cm. Ideally, the exhaust port area is equal to the ZuluftÖffnungsfläche. So you If one adds this area, resulting in a total opening area of 3.6 cm²

- Which is very close cm² on the area of 4, the Professor Thomas D. Seeley found for the preferred by the bees hive entrance has size. Evidently this entrance hole size is preferred not only because of the better defensive option against robbers, but also because of the air flow control - it is at least close! The bigger the mass air flow is, the more must this air mass also be heated by the bees, which requires more power from the bees. If one were to combine and extract air opening area, results in the following by

diameter:

$$\text{diameter}_{\text{circle}} = \sqrt{\frac{3.6 \text{ cm}^2}{\pi}} * 2 = \sqrt{\frac{3.6 \text{ cm}^2}{3.14159}} * 2 = 1.070471859 \text{ cm} * 2 = 2.29 \text{ cm}$$

With a rectangular shape of the air hole has a square shape for the flow of air would be best, but because of the mice protection a slot is usually chosen with a height of 0.6 cm - it is then followed by an entrance hole length of 3 cm. (In the winter.) So one air hole would be sufficient as Zuluftsöffnungsfläche. Would the entire ventilation (supply and extract) operated out of this slot (the "mouth" principle, more on this below), the area would have to be doubled, which means an entrance hole length of 6 cm with a height of 0.6 cm.

So it is in nature

In nature, bees mostly inhabit tree holes that have been formed by fungus that accumulates the tree. The oft-quoted woodpecker holes are not suitable at all, due to a too small volume, due to the too large aperture also eats in the top third of the nest. The fungus from a dead branch from above the leaf node in the tree - that gives the typical "eyeholes", ie more or less circular holes in the eye of a leaf node. The fungus then rises in the trunk of the tree with the sap of the tree to the top - which is why the entrance hole and is most often in the lower third of the stem. Compare with Figure 3 shows an image of the real Leben. Augenfällig is that there is only one entrance. In today's architecture is cross ventilated especially. There is usually a supply and an exhaust vent. The Bienenbut comes with an opening made - as we humans fill our own lungs of even a mouth with fresh air and CO₂ and breath moisture abführen. Etwas nature will have been thinking

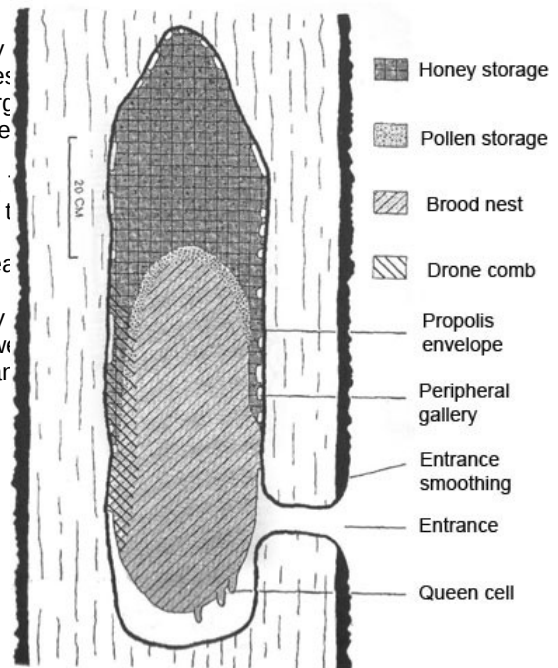


Figure 1: Nest of the Honeybee: figure from the same book that the natural bee

nest is in a tree.

- And we humans apply the principle quite similar in our building technology - the heat exchanger! The coming of outside, still cold air flows along the warm exhaust air to the outside. In this way, the heat is exchanged and the inhaled air is preheated and not true completely cold in the body, which characterized the warming of zero is spared. The heating of the air mass flow falls so easily.

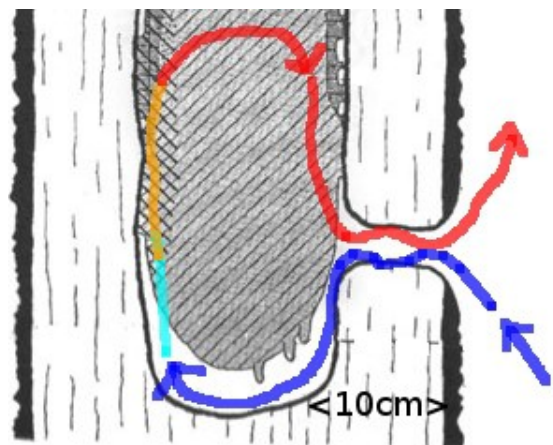


Figure 2: History of Lüftungsstromen.

And so it is with the Bien. The wall thickness of the hollow tree trunk is according to the investigation of Prof. Seeley mostly 10 cm - so long is the tunnel, which forms the exchange Wärme. Dabei moves the cold air, because it is heavier, there she first falls down once in the shoulder. In a room air effect called Coanda effect.) The cold air falls down into the high ground, entrained upwards when the warm air flows out of the entrance hole. reaches the top the tree hole - where the honey is, which is heated, finally out of the entrance hole to escape. Dieses gravity slows down the air stream. Throttles it too strong, flows less cold, increased buoyancy and thus again to an increased exchange. and boxed hives with only one entrance hole in winter: There is no flowing inward air. I have reported on December 5, 2012, at the important that the dimensions of the throttle more or less influence the "breathing" of Bienen! .The whole system works only because the thickness of 10 cm solid wood is not critical, but that the tree has a certain inherent heat and frost protection reaction. (Displacement of more or less interior greatly influences the temperature and a system works only because the tree cave is heavily insulated, crucial, but that the tree usually so juice is still alive and leads to a protection reaction. (Displacement of water inside, that the direction influences the temperature and a crucial role in the "breathing" of the tree cave is heavily insulated, which is not the wall thickness, but the juice is still alive and leader! The living tree has a certain inherent heat and frost protection reaction. The living tree has a certain inherent heat and frost protection reaction. The living tree has a certain inherent heat and frost protection reaction. another function: it acts as a kind of porch.



Figure 3: A populated with a bee colony tree. The entrance hole in the knothole. The calculated 23 cm diameter

are given here!

²<http://de.wikipedia.org/wiki/Coand%C4%83Effekt>

³http://www.waldwissen.net/wald/klima/wandel_co2/bfw_schrumpfen_baumstamm/index_DE

Transfer to the hive

How then can these findings be transferred to the hive? A wall thickness of 10 cm - especially juice leader - can not be realized. Here a sufficient insulation of the hive is at least necessary, which prevents the cooling of the interior walls and thus the formation of condensation. Cool interior walls also prevent the self-regulation of the ventilation flow, because if the heat to the outside or condensation is lost, not created enough lift. The engine stutters, "breathless". Literally!

insulation

Which insulation can be used to isolate the prey, is still the subject of further investigations. Styrofoam is indeed the first thought, but measurements under the Chelifer / Books Scorpio project have shown that the humidity is significantly increased in Styrofoam booties over wooden hives. This is due to the vapor-blocking effect of styrofoam. Extremely thin and ultra-insulating (a Wärmedurchgangskoeffizient of 0.007 W / mK!) Are vacuum panels, wherein a bag (Perlite z. B.) filled as a support structure with a porous material and then vacuumed. A thickness of 3 cm is already sufficient to achieve a thermal transmission coefficient of 0.224 W / m²K! For this you would need a 22 cm thick straw wall to reach this value. But how can such an insulating material integrated into a hive is questionable. Possibly as a filling in a cavity wall construction in Leichtbauweise. Als Another idea for a reaction is the use of so-called Holzhäckselschutznetzen, the wind and rainproof are mostly - so the underlying lies ahead protect wet and windy conditions, but at the same time allow for drying. Such nets can be placed to protect against the elements over piles of wood chips.⁴ These networks could be placed loosely around the hives and stuffed with straw in a thickness of 10-15 cm. The straw would significantly improve the Warmhaltigkeit and the cargo net keeps out the rain and the wind. (If wood chips are allowed to dry under, then a Bien.) Whether and which solutions are practical, is to be proven. At least for magazine Booty, who are nowadays the most common, it is a significant difficulty. Trough booties in the good old beehives have it as easily!

⁴[http://www.siepmann.net/siepmann_shop.php?](http://www.siepmann.net/siepmann_shop.php?catebene1=190&action=show_product&product_code=123464&page=1&show_category=190)

[catebene1 = 190 & action = show_product & product_code = 123464 & page = 1 & show category = 190](http://www.siepmann.net/siepmann_shop.php?catebene1=190&action=show_product&product_code=123464&page=1&show_category=190)

Positioning and size of the air hole

Looking at the natural bee's nest, so it is very clear where the entrance hole has to sit and how it is dimensioned. The entrance hole should be positioned in the lower third of the beehive and be designed as a circular hole with approximately ~ 2.3 cm in diameter. What then is missing here in a modern magazine, is the recovery in the tunnel. Say, the wall thickness. How to be solved in the magazine, is a good question! Figure 4 shows a possible solution. At the entrance hole in the frame, a piece of wood is placed and secured. (Angle.) It has a circular tunnel and ends up and down with the straw insulation. Right in the picture the Schutznetz. Eine Such a construction is, of course, just for the winter - and not for the summer, when the moveable hives are to be moved. In modern Viehstallbau there are a plurality of ventilation systems - most ventilated, ie with fans. There are various systems, such as the jet aeration, the Rieselkanalbelüftung (with perforated plates), the feed alleys or ventilation pores ceiling ventilation, where the ceiling is provided with fine pores. In the pressure chamber about fresh air is introduced and then through the pores downward trickle gelassen. Die pores ceiling ventilat

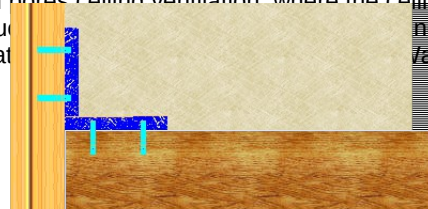


Figure 4: A possible solution? A made of a timber piece of wood placed on the flight

hole of the frame.

éPillow. After all

accumulates in the heat and the air could, at least theoretically trickle through the linen cloth down. However, the direction is set in the pores ceiling ventilation: from top to bottom. And that is important because otherwise the whole system will not work. The WarréPillow is the way it is, unfortunately, not the solution.

Principles of ventilation

To suspend the Bien no train, the following general principles for the ventilation must be upheld.

- If possible, the fresh air preheated out the room.
- Exterior wall surfaces are easy to insulate.
- No cold air from above.
- Avoid jet aeration.
- Air velocity in the boot > 0.1 m / s.
- introduce the supply air from the warm weather side (south) ago.
- run to the cold side. (North Wind?)
- The outlet of the air at the highest point.
- As few changes in direction of the airflow at the inlet and outlet.

- The opening areas should have a large cross section. (Circle form is better than slot shape.)
- Smooth surfaces in the entry and exit area.
- The airflow should omit possible no corners or the entire room flow through.

Possible solutions

A floor with a perforated plate and a small air hole at the top, could be a solution to ventilate the room sufficiently without train, because the air flows slowly here.

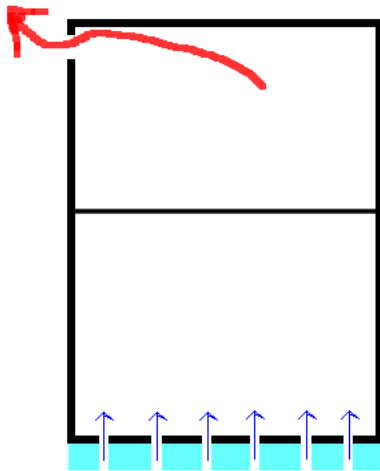


Figure 6: perforated plate of insulating material. The sum of all the inlet opening areas to 1.8 cm². The outlet according to a size of 1.8 cm. Out

occurs is at the same entrance hole.

Canadians have good experience in the winter of peoples in extreme cold with a flight hole up and down.⁵(Figure 7) In investigations turned out⁶That this constellation ventilation mass flows increased by a multiple, which naturally reduces the risk of condensation, but demanded an increased heat output of the bees. But sinking the lower air hole in Canada early winter in loose snow, which is porous and permeable to air - arises almost a constellation, as shown in figure 6. The Canadians use so-called "wraps", insulating sheaths, which are also available for purchase. (For example: bee cozy⁷)

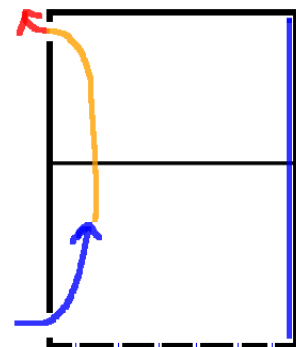


Figure 7: Air hole up and down on one side. The opposite side

⁵Siehe: <http://capabees.org/content/uploads/2013/02/winteringpdf.pdf>⁶Nachzulesen

in of the Job:

<http://www.uoguelph.ca/canpolin/Publications/Sudarsan%20et%20al>

% 202011%% 20flow 20currents% 20in% 20Langstroth% 20hives.pdf

⁷<http://www.nodglobal.com/bee cozy.html>

is poorly ventilated.

As quite unsuitable, represented at least the bare design as shown in Figure 8, the "entrance hole above" must be considered (without open areas). The incoming air mass first drops off down - just as in the natural nest of honeybees. The crucial difference is that the mass of cold air is to the entire height of the sidewall and so this wall and adjacent honey strongly cools. The brood nest and the winter cluster is pulled upwards simultaneously to flight hole, gasping for breath, so to speak, where they are caught more or less and can not nachwandern the feed in the winter. Especially in hives with small honeycomb as the Warré makes something quickly noticeable, cool to from strong because the honeycomb width is small and the bees to cool air can not escape.

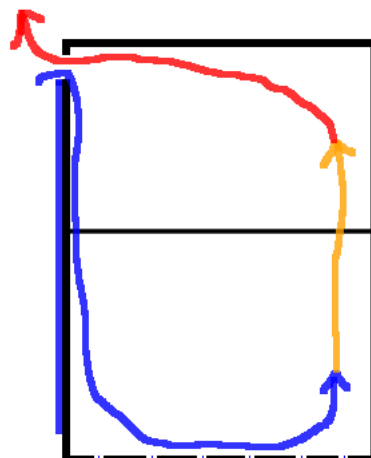


Figure 8: Only one air hole above positioned. ("Top entrance")

(Not to mention the unnatural honey stacking and distribution in the honeycomb, the cooling of the honey cap on standby waiting for the beekeeper guard bees under the lid and the increased Räubereigefahr [relatively short distances to the honey bearing])

It would be different, perhaps with a special cover, which has two chambers. A lower chamber in which flows the air through pores - for example, a dense fly screen - sags downward, and a second upper chamber in which the exhaust air is discharged to the outside.^{8th}

The warm air is let out in the middle of the ceiling with a kind of funnel upwards, directed against a fungus, which deflects the flow down towards the lower chamber ceiling, allowing the heat exchange of the two air streams.

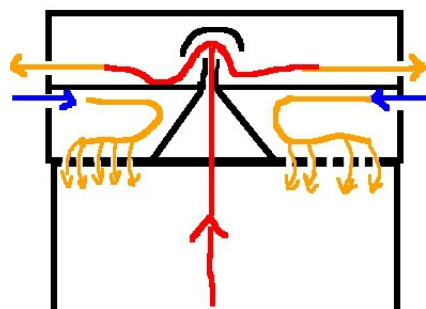


Figure 9: A patch "Klimazarge". Much like the

There are certainly many ways, among which the best, most practical and bees fairest solution still needs to be filtered out - but who searches will find!

Klimazarge after
Freres & Guillaume.

From her feel the solution of natural nest is most optimal for the Bien - "follow nature, ie, choose the right path" (RH France).

⁸Siehe also: Freres & Guillaume, <http://warre.biobees.com/guillaume.htm>

