

MODERNIZATION OF BEE EQUIPMENT IN CONNECTION WITH THE TECHNOLOGY OF HONEY

P. LAVIE - France

Honey is, first of all, a consumer's article and as such it ought to reach the consumer having kept most of the qualities it had in the hive during the honey harvest. To achieve this aim, gathering and preservation of this complex and perishable product must be carried out with utmost care so as to avoid any damages. Modern market requires stable and well-presented products: honey must be sold in a well – defined physical state, either fluid or slightly crystallized, of perfect appearance and well preserved. The economic necessity of storing honey in order to sell it at a favorable time, without any depreciation, also favored the development and modernization of both equipment and methods, either as regards apiarists, co-operatives or tradesmen .At present, there exists a complete technology of honey, as there exists one for each food-stuff. To provide the technology of a certain food-stuff with the sound bases it requires, one must first of all carefully study the physical and chemical characteristics of this product, and this has not always been the rule. We must respect honey as food-stuff and perform certain operations with the utmost care. An important difficulty is brought about by the fact that honey composition is very diverse. Treatments must be adapted to each type of honey. For instance, the thixotropy of *Calluna vulgaris* honey forbids the use of ordinary methods (as regards extraction, filtering and heating) There are many other examples which, nevertheless, are less specific than this one.

The chief factors which can alter the quality of honey are the rise in *temperature* favoring a large number of reactions bringing about its decomposition and the *too high water contents*, favoring the fermentation in the presence of yeasts. In the third place, *gross crystallizations* must be avoided so as to better present the product for tasting. In Europe, efforts are made to avoid an intense heating of honey, in order to preserve untouched its biological constituents but a compromise is necessary because the rise in temperature favors, on the other hand, the apiarist's work. The "*heat chain*" from the collecting of honey till its introduction in jars is a "must" in spite of the critics brought in this respect. If moderately heated (35°C), dehydration of honey while in honeycombs, centrifugal extraction, pumping, filtering and decantation are much easier. But at this stage, the temperature is more or less that existing inside the hive. If temperature rises abruptly, it is possible to destroy yeasts and to melt the germs of bad crystallization; this is the principle of pasteurization. In the first case, each apiarist can and must respect this "heat chain" but he must also know how to use it with caution. As regards pasteurization, it is an operation which is particularly useful for tradesmen and cooperatives having to handle an important tonnage of honey.

In this report, I voluntarily insisted on the efficiency of the methods and the preserving of the constituents of honey during the various operations, in harvesting as well as in conditioning. In the meantime, I did not particularly stress, although I do not ignore them, the problems related to the efficiency of the equipment and methods as well as the organization of work in apiaries.

PROBLEMS TO BE SOLVED AND CHIEF DIFFICULTIES

We have already got a general idea of some of the problems which have yet to be solved as regards the technology of honey-making, because of certain physical and biological properties. We shall not, however, enter in all these details in this paper and shall limit ourselves to giving a few examples.

a) Honey is very easily heated and its specific heat is so high that it requires 200% less calories to heat it than to heat water. But, on the other hand, honey has a very bad heat conductivity and it diffuses heat but little. Its heating and remolding will have to be achieved with the utmost care so as to avoid local overheating which would deteriorate it very much. To make certain pumping operations cashier, taking into account the viscosity of honey, it is necessary to heat it up to a temperature of approximately 35°, (according to its water contents), a fact which favors its circulation. On the other hand, any heating of honey, even at 35°, during a sufficiently long time, alters more or less sensibly certain thermo labile factors. Amylase, invertase, are partly destroyed by too prolonged a heating. Likewise, the very color of honey changes and its contents in H.M.F. grow.

b) To rid honey of any impurities, beeswax particles for instance, it must be filtered. Some of its impurities, favor gross crystallizations. Nevertheless, if we want to respect the presence of the pollen which characterizes the origin of the respective honey, we are obliged to adopt a compromise and to use filters the mesh of which do not exceed 2/10 or 3/10 mm.

c) It goes without saying that every modern beekeeper uses a centrifugal extractor, a basic tool in beekeeping. Still, the present extractor should be improved because this device airs honey much too energetically, the moment it is projected out of the cells. The result can be but very bad, since numerous air-bubbles are introduced in honey, thus favoring the appearance of certain oxygenations reactions. The

extraction is a very important operation in other respects too, namely as the spreading of diseases is concerned. In case of the extraction of honey from *Calluna vulgaris*, the apparatuses used before the extractor (the „emulsifiers”) actually inseminate pathogen microorganisms from one honeycomb to another. Still, at the present stage, there is no other solution. These are some technical problems which it would be very interesting to solve. The drying of the capping also raises the problem of honey oxygenation but the melting of the capping is not very satisfactory either, because the local overheating of honey sensibly alters its color.

d) The too easy way of using certain chemical drugs for harvesting supers requires certain precautions so as not to give honey an unpleasant taste.

e) Decantation and purification have to be carried out with the utmost care. We already know, in Montfavet, that honey lying for several weeks, at a temperature of 35°, in a vat, suffers certain changes (appearance of HMF, coloring, loss of diastases) sometimes even more important than after a pasteurization at 76° during 6 minutes. The purifiers must be of a size favoring a swift rising of the impurities and must always be placed in a perfectly dry room so as to avoid an absorption of water, honey being very hygroscopic.

f) The pasteurization of honey is a very ample subject with which I shall not deal in this paper. This operation is already well-known and the few damages it causes are amply compensated by the advantages obtained. Protected pasteurization grows more and more popular in all countries and has been carefully studied. It is easy to obtain a honey devoid of any yeast, keeping its fluidity six months. The putting into jars, at its coming out from the apparatus must be controlled so as to avoid any insemination due to atmospheric dust and containers must be perfectly clean otherwise the whole operation is useless.

g) Controlled crystallization of honey presents numerous difficulties even if one has adequate equipment. This is often due to the ratios between the various constituents of honey, namely those of sugars and the water content.

h) Preserving of honey is often neglected. Still, in a recent study, GONNET (1965) showed that the conservation temperature exerts a great influence on the constituents of pasteurized or non pasteurized honey. There exists a non negligible difference between the storing of honey at + 14° and that at + 20°. But even at + 14°, honey changes and certain substances are altered after one year storing. This is a particularly important problem of main interest for countries having a subtropical or tropical climate which have to store honey in the best possible conditions.

i) I shall end this enumeration by saying a few words on the melting and remolding of honey. The difficulties of this operation were noticed by certain research workers and, in 1958, LOUVEAUX and TRUBET published a technical study on this matter. For the reasons I have already evoked above and because of the heat conductivity of honey, it is preferable to divide the mass of honey; it is advisable, for instance, to use small rather than large, 300 kg. casks. And, finally, one must not forget that all heating operations undergone by honey since its harvesting pile up and that if one multiplies them unwisely, the result can be but a severe deterioration of the product.

CONCLUSION

To conclude, we shall stress that, in spite of the up to date equipment which is being placed at the disposal of present apiculture, there still persist grave deficiencies and the technology of honey has left its empirical stage but a few years ago. Serious studies on honey will permit to draw up, in future, perfectly tested methods as well as better designed apparatus. The sparsely studied equipment should be abandoned and the same applies to certain methods of working. Certain machines which have been advertised as being able to increase labor capacity often prove to be completely useless. To give an example of this, I shall but mention the recent study published by PIEL-DES-RUISSEAUX (1965) who showed in a very exhaustive study on honey extraction in France that the electrical cap-removing machine is less rapid than the electrical cap-removing knife or even the ordinary knife for a batch of medium loaded honey-combs. It seems thus that the mechanization of certain apiarian jobs is not always advisable. And, at last, one must beware of the new devices which have just made their appearance on the market and which have been sometimes made of faulty materials, without observing the rules dictated by the very logical bases of honey-making know-how. A standardization of the equipment will be ever more necessary in the coming years, observing at the same time the needs and legislations of the various countries. One must find the solutions which could, as far as possible, meet the following requirements:

1. Efficiency of the expected results and integral preserving of the qualities of honey a food-stuff;
2. Reasonably low cost price;
3. Rapid operation and good organization of work in apiaries.