A SIMPLE MECHANIC DEVICE FOR THE EVALUATION OF THE COLONY'S ACTIVITY; METHOD OF INTEGRATION OF THE ACTIVITY CURVES

R. CHAUVIN, FRANCE

Numerous attempts to evaluate the bees' activity took place. The operation is very difficult, as their activity shows enormous variations between the flow period and the other periods. I myself (CHAUVIN, 1974) described various mechanic devices which allow a summary evaluation of the activity. Recently, the description of a device based on photoelectric cells, which counted the bees coming out of the hive through several tubes, was published. This device is precise, but it needs thorough maintainance. The drawback is that its very high price (over 50.000 FF) makes it practically impossible to be used in beekeeping on a current basis.

My aim was different: Would it be possible to build an apparatus with a low cost, which would offer us an evaluation, which is not quite rigorous, but is sufficient, of the activity of the collecting bees which go in and come out of the hive?

And, after over forty years of attempts, I have succeeded.

Principle and Description of the Apparatus

First, we must install on the floor of the hive the well known Foloppe device, in figure 1, which allows us to separate very easily the collecting bees that come in from the ones that come out. Thus, they are forced to go in and out through two openings, placed one near the other. In front of each of these openings, we must put a very light plastic tube, which is 20 cm long and has a diameter of 1 cm and a weight that should not exceed 500 mg. At the level of the first third of its length, it is suspended from a metallic wire, which is fastened to the end of an inscriber. The only device that needs to be purchased is a recording cylinder, like the ones used in thermographs. The cylinder is electrically activated and has two speeds: a 24 hours' rotation and a 7 day's rotation. The inscribing stylus must be made of very light and flexible plastic. At one end, it will have a pen with an ink tank (the "Fibrodian" type from Prolabo). The weight of the bees going in and out will move the arm of the lever thus formed. These movements are transmitted to the ink pen, which will inscribe them on the cylinder under the shape of a continuous curve.

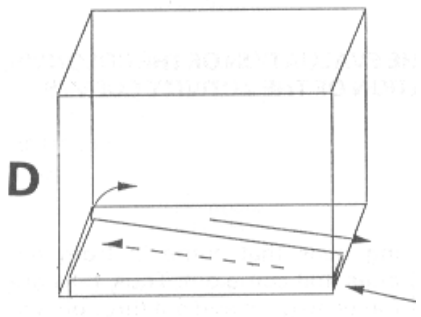

Fig. 1 – Beehive equipped with the classical Foloppe device. Almost half of the floor surface is covered with a false floor, under which the bees returning to the hive pass. The bees' trajectory is represented by the dotted arrow. The bees that come out pass freely, being attracted by the light. But, we must install a transparent prolonging, without which the returning bees would come in by the same entrance. The transparent extension, which is meaningless for them and which they do not avoid, will prevent them from doing this. The apparatus which measures the activity is fixed on this device.

The problem of the Articulation of the Tube to the Hive

According to its description, the device is very simple, but, in order to build it, I had to solve a problem which seemed minor, but which kept me from making progresses for a few years. The lever tube obviously oscilates, but how could it be connected to the tube in the case of the rather large movements of its end? **No joint proved to be applicable**. Indeed, the device has only a force of a few centigrams (the weight of the bees in the tube), and the slightest friction obstructs the movement of the lever. The only solution was the utilization of a very fine nylon tissue, similar to that of which the stockings are made, in order to joint the tube to the hive. The elastic joint thus obtained allows the tube to oscillate freely. This joint is fixed to the tube, as well as to the hive, by a simple soldering. At first, some of the bees tangle their tarsian claws in the nylon tissue and do not manage to detach themselves from it. But this does not last long, especially if we lubricated the nylon with a diluted propolis solution.

Results

The recorded curves may be very easily read at first sight. We may notice a strange phenomenon, of which I remember to have heard: the collectors come out in teams, fact which is very well reflected in the continuous and very close oscillations of the exit tube during the active stage. The returning bees give a different image, although they also cause very marked oscillations, which are even stronger than the ones caused by the bees which come out, because the weight of the former is increased by the presence of the nectar on their body.

Conclusion

There is no doubt that the beekeeping does not need an evaluation of the bees' activity at the level of 10 or even of 100 bees in the periods of intense activity, when over 20,000 collectors leave the hive.

However, this measurements is not quantitative: for this purpose, the oscillations of the curve should be integrated somehow.

The Integration Method

I managed to set up a method of purely mechanic integration which gave satisfactory results. This method is described in figure 2, C, which makes it easier to be understood. A horizontal wire is fixed, at one end, on a runner and, at the other end, on a counterweight which slides on a fixed glass cylinder, so that the counterweight on one hand and the friction with the cylinder on the other hand, be enough to maintain the runner motionless. But, a hook linked to the recording stylus by a wire may break this balance by the traction exerted when the stylus moves downwards. In this case, the runner moves in proportion to the amplitude of the stylus oscillation. Figure 2, C indicates the components of this device.

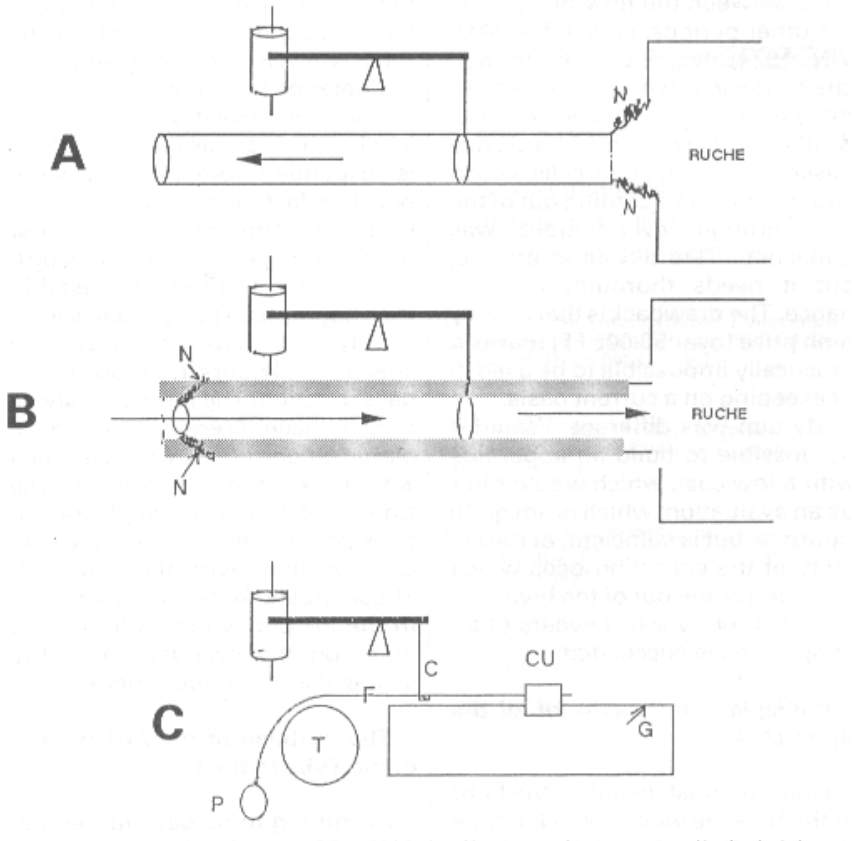

Figure 2 – A. The Exit Tube; B. The Entrance Tube (which is closed in an opaque box – represented by the shaded area – inside which it may oscillate); C. The Nylon Tissue Which Makes the Link; C. The Integrator: c. The Hook That Links the Recording Stylus to the Wire F; CU – The Runner; P – The Counterweight; G – The Runners' Guide; T – The Glass Cylinder. Characteristics of the Components: the Runner's Weight: 1 g; the Weight of the Counterweigt: 0.6 g; The Diameter of T: 2 c

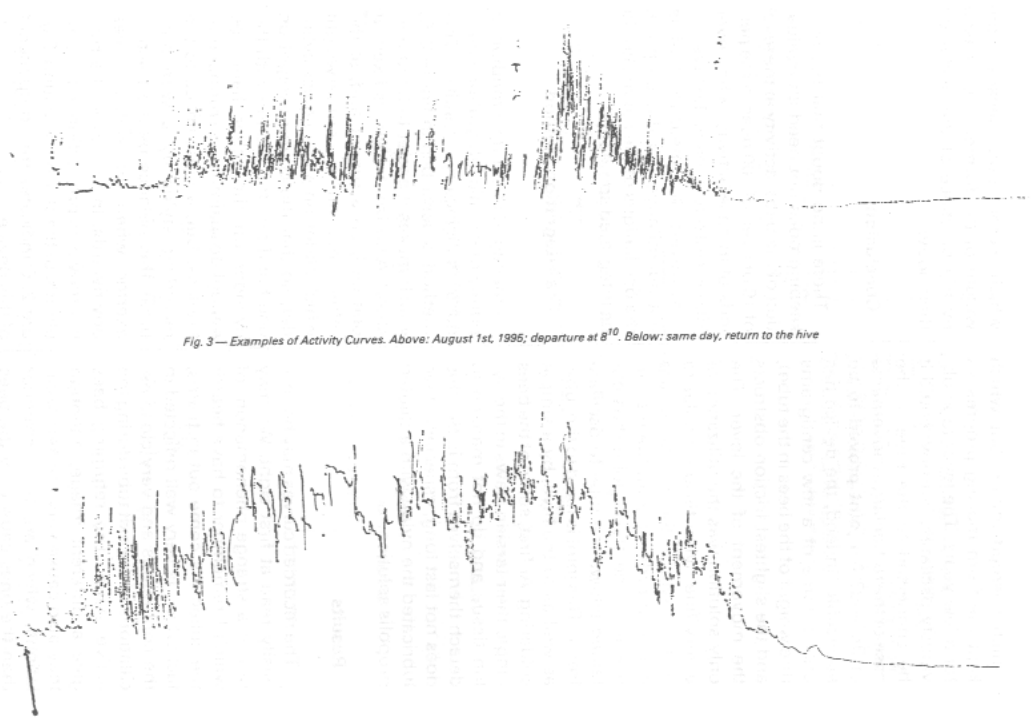

Figure 3 – Examples of Activity Curves. Above: August 1st, 1995; departure at 8^10. Below: same day, return to the hive

By this method, we obtain, at the same time, a continuous curve which corresponds to the global activity of the hive and, on a graduated ruler, a figure which corresponds to the integration of this curve at any moment.

It is too early to compare my results with those of STRUYE et al., to which I refered at the beginning of this report. In both cases, one may observe the going out and the coming in "in teams" of the bees that leave the hive or that return to it, although this phenomenon is more obvious according to my recording method. Anyway, the bees do not go out and come in on a regular basis… The apparatus built by STRUYE et al., is, of course, a reference model, but it is not practical because of its very high price. A methodical study of the activity of the colonies could imply, in a compulsory manner, the utilization of several devices at the same time, on several beehives, which is difficult to achieve from the financial point of view!

Finally, I would like to mention the fact that I tested more than one method of electronic evaluation of the bees' activity, much more simple than the device mentioned at the beginning of this paper. It simply consists of compelling the bees to pass over a proportional photoelectrical cell, in other words, over a luxemeter. We should not use photoelectrical cells for any trifle.

Acknowledgements

I thank Mr. Charles, an engineer at INRA, who helped me a lot by building various prototypes of these devices.

REFERENCES

CHAUVIN, R. (1963) – Essai d'enregistrement simultané des principaux phénomènes de la vie d'une ruche. *Ann. Abeille*, 6 : 167-183

CHAUVIN, R. (1976) – Sur la mesure de l'activité des abeilles au trou de vol d'une ruche à 10 cadres. *Apidologie*, 5 : 191-195

STRUYE, M.H. ; H.J. MORTIER ; G. ARNOLD ; C. MINIGGIO ; R. BORNECK – Microprocessor Controlled Monitoring of Honeybee Flight Activity at the Hive Entrance (to pe published)