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How can 3D printing help your lab : the example of AphiCell

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3D printing exists since the 1980s but was only used in industry until recently. However, the additive technology has now become open-source resulting in lower prices of machinery and consumables. Depending on the process and the characteristics of the printer, it is possible to create objects in different types of materials, ranging in size from a few millimeters to several dozen centimeters.

In a research laboratory, a 3D printer has several advantages, including the possibility to manufacture novel articles, not found commercially and exactly fitted to the needs of the laboratory.

In our laboratory, 3D printing has given a facelift to the clip-cages that we used for virus aphid-transmissions [1]. The clip-cages have been described for the first time in 1957 [2] and have been used since by many laboratories worldwide. Different versions were subsequently created, which have the advantage of being very cheap since they are manufactured manually. However, they have the big drawback of being inconvenient to use because they do not stay well in place and are difficult to clean. Using 3D printing, we developed a new model of cage that had to present the following characteristics :

- possibility to fix the cage on a support so as not to put its weight on the leaves,
- possibility to deposit the aphids in the cage, on the upper as well as on the lower surface of the leaves,
- tight closing of the two parts of the cage to avoid insect escapes,
- no wounding of the leaves.

We have thus developed the clip-cage's little sister, called AphiCell. AphiCell has an operating principle different from the traditional clip-cages and has many advantages for use. AphiCell is printed in 3D, cleans up easily with water and depositing aphids inside the cage is facilitated. We have also checked that the use of AphiCell prevents the dispersion of aphids on the plant or outside, facilitating their removal thereafter while avoiding the use of pesticides. Validation of the efficiency of AphiCells for the transmission of persistent and non-persistent viruses is underway.

3D printing for a laboratory is also producing articles at a much lower cost –50 to 100 times cheaper than buying retail price- than usual purchase from specialist suppliers. These easily printable objects include tube racks, pipettes holders, electrophoresis combs, or pipettes. Some of these models are available online.

Using a 3D printer in a research laboratory makes it possible to save money and have a material adapted to the specific needs of each team. The development of a "3D network" Inra / CNRS could allow for sharing the models developed by each, for free so as to preserve the spirit of the Open source.

Références :

[1] Millot P. (sous presse) AphiCell : comment l'impression 3D a révolutionné la clip-cage pour la transmission de virus par pucerons. Cahiers des techniques de l'Inra.

[2] MacGillivray ME, Anderson GB (1957) Three useful insect cages. *The Canadian Entomologist*, 89 : 43-46, doi:10.4039/Ent8943-1.

Mots-clés : Clip-cage, aphid, transmission, virus, 3D printer.



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