The Practical Use of Biotechnology in Agriculture High School Education

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INTRODUCTION

Biotechnology education was introduced to the curriculum of Hiratsuka Agricultural High School in 1990 when the three departments of the school were reorganized. The aim of the adoption of biotechnology education was to give the students a deeper understanding of living things and also to give them some confidence in agriculture. The main aims were to give the students some basic technology, such as sterilization using a newly-built clean room, or showing them themes for research.

SOME PRACTICAL EXAMPLES WHERE BIOTECHNOLOGY WAS USED

Experiments in Multiplication of Disease-Resistant Eggplants. A common problem with eggplants grown continuously in the same field, is the occurrence of a disease called *Verticillium* wilt. So the development of disease-resistant eggplants was tried first. Healthy plants were chosen in a field where the disease was present and from those healthy plants, some healthy leaves were taken and cultured (Fig. 1). The newly obtained small plants were planted and compared with the grafted healthy plants from the continuously used field. In these two kinds of plants no differences were found and no sign of disease appeared in the new plants. The result of this research was presented at the Japan Students' Science Exhibition and gained an award from the governor of the prefecture.

Figure 1. Shoot formation from leaf of eggplant.

Micropropagation of *Lilium auratum* Lindl. by Tissue Culture. *Lilium auratum* Lindl., which is known as the flower of Kanagawa Prefecture, has decreased in the wild recently because of the deterioration of its natural environment and rapid urbanization. Tissue culture was adopted as the first step in increasing the numbers. Healthy flower buds were taken from plants growing in the field. Each part of the organ (filament, style, anther, and stigma) was separated and cultured, and the highest percentage of bulbs were obtained from the filament. The concentration of sugar in the culture medium was found to be largely responsible for the size of the bulb.

We made a liquid-culture device by utilizing empty juice bottles and also made a simplified water pump. By using these devices the multiplication was done more efficiently (Fig. 2). A patent was obtained for this device. The bulbs obtained through

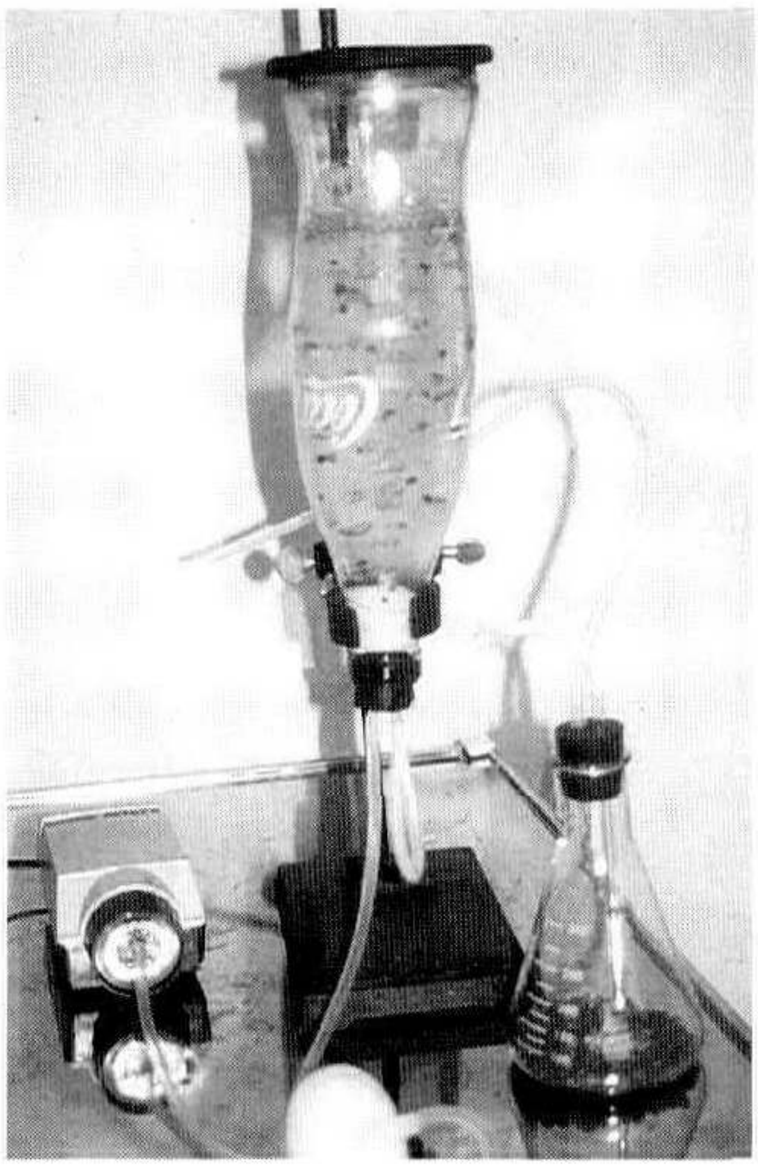

Figure 2. A simplified water pump and chamber.

culture were cooled and acclimatized and in 2 years produced flowers.

Rose Growing Using Virus-Free Plants. One of the students, who was planning to follow his father's profession of rose growing, experimented with growing virus-free roses using the shoot-tip culture method on the cultivar Tineke® rose. He cultured the plants in rockwool and obtained cut flowers with a better quality and a longer life expectancy. He received first prize in the " All Japan Agricultural Club Conference of High School Students."

An Investigation of Bud Development of *Phalaenopsis* Using a Scanning Electron Microscope. The germination of virus-free seedlings of *Phalaenopsis* was observed through the scanning electron microscope belonging to our school. The seeds are very small, with a diameter about 0.5 mm (Fig.3), however, within 10 days the growth of the embryo was recognizable and within 30 days the protocorm could be seen (Fig. 4). This process was shown at the World Orchid Exhibition.

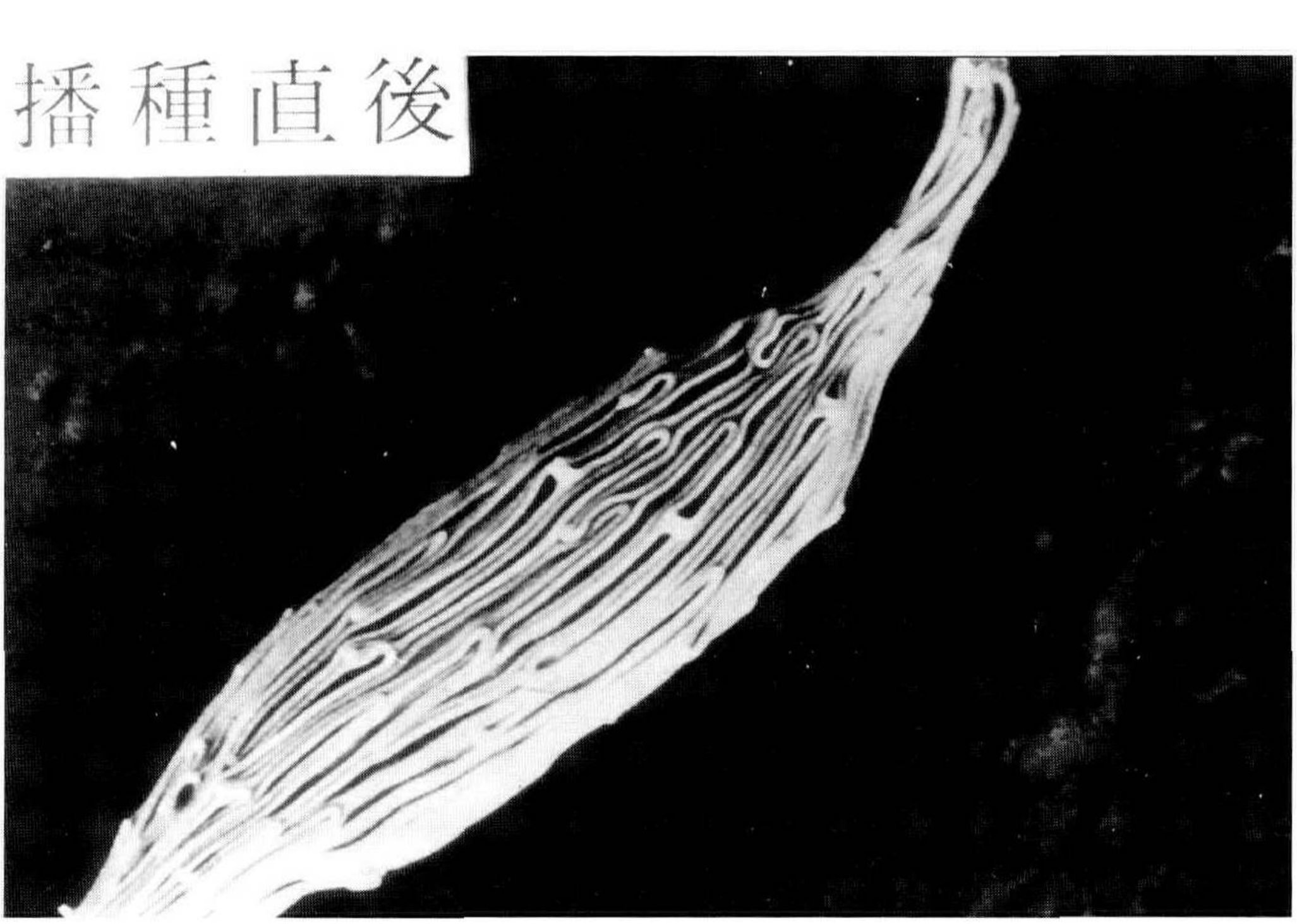

Figure 3. Scanning electron micrograph of *Phalaenopsis* observed immediately after the sterilization.

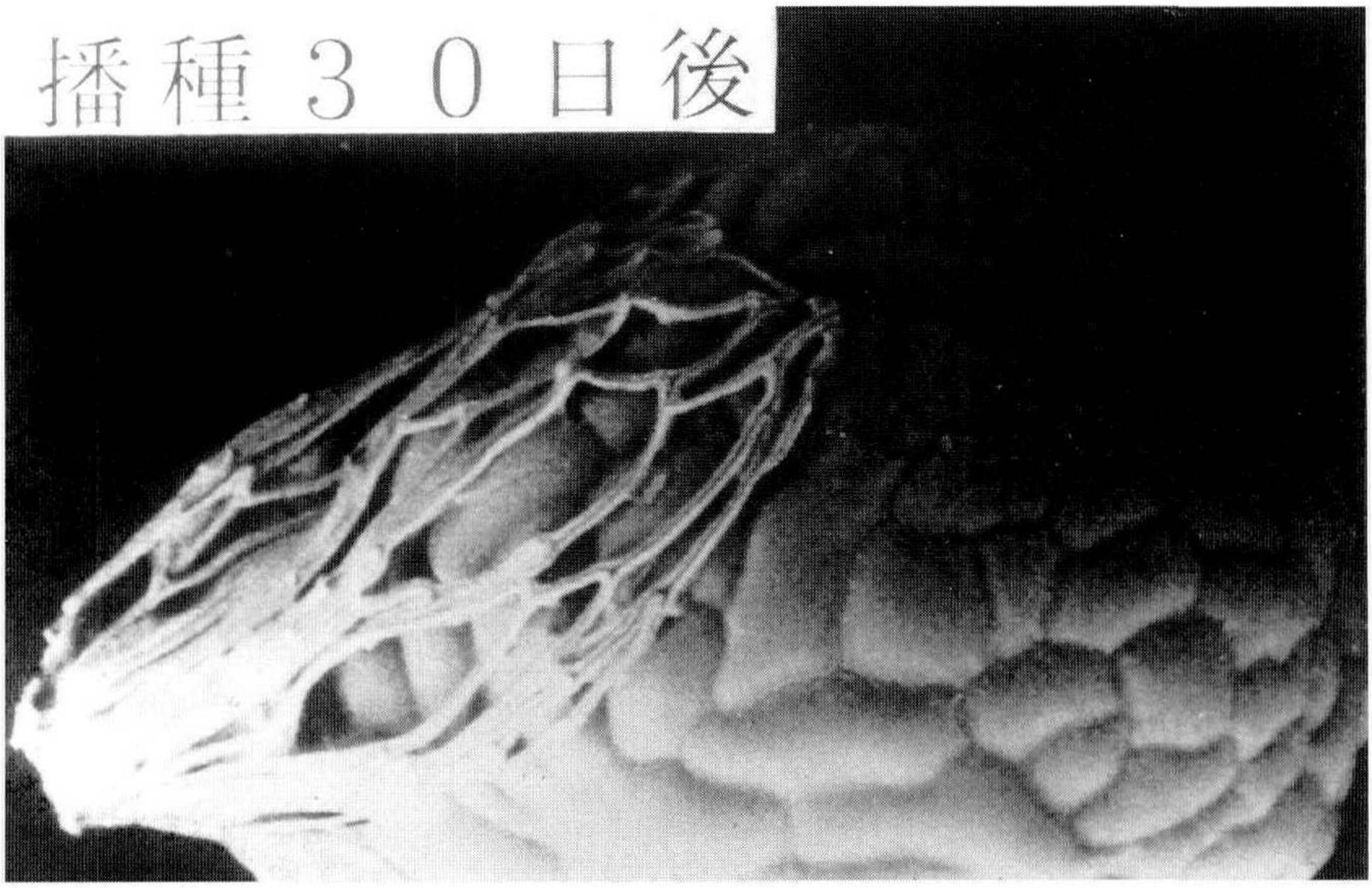

Figure 4. Scanning electron micrograph of *Phalaenopsis* observed 30 days after sterilization.

THE EFFECT OF BIOTECHNOLOGY EDUCATION

The students were very interested in the study of biotechnology and we were able to give them more confidence by presenting them with opportunities to make public their ideas and the results of their research. Biotechnology education is not only necessary but can help to answer the problems associated with modern agriculture, it can also be a very effective method of developing students' thought processes. We are now considering biotechnology education as a means to motivate them, in doing so, in our opinion, we could contribute a great deal to the education of the students of agriculture.