MICROPROPAGATION OF PLANTS
(МІКРОКЛОНАЛЬНЕ РОЗМНОЖЕННЯ РОСЛИН)

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У статті йдеться про сутність мікроклонального розможення рослин, його застосування та методи. Наведено переваги та недоліки мікророзмноження та його значення для людства.

Ключові слова: *мікроклональне розмноження, рослини, культура, селекція, лабораторія, сільське господарство.*

The article deals with the essence of microclonal plant propagation, its application and methods. The advantages and disadvantages of micropropagation and its importance for humanity are presented.

Ключові слова: *micropropagation, plants, culture, selection, laboratory, agriculture.*

Plants can be propagated by sexual (through generation of seeds) or asexual (through multiplication of vegetative parts) means.

Clonal propagation refers to the process of asexual reproduction by multiplication of genetically identical copies of individual plants. The term clone is used to represent a plant population derived from a single individual by asexual reproduction [4].

Asexual reproduction through multiplication of vegetative parts is the only method for the in vivo propagation of certain plants, as they do not produce viable seeds e.g. banana, grape, fig, and chrysanthemum. Clonal propagation has been successfully applied for the propagation of apple, potato, tuberous and several ornamental plants.

In vitro culture of plants in a controlled,sterile environment

Methods of Micropropagation:

Meristem Culture. In this method of micropropagation, subtending leaf primordial and a meristem is placed into their respective growing media culture and allowed to grow. After some weeks, an elongated rooted plantlet is produced. Once after they reach a considerable height, these plantlets are transferred into the soil. In this method, a disease-free plant can be produced and can be

successfully used for rapid multiplication of various herbaceous plants [1].

Callus Culture. In this method, selected plant tissue is placed in an artificial growing medium culture until the callus is formed. After the production of callus, they are transferred into a culture medium containing plant growth regulators for the induction of adventitious organs. After a few weeks, a new plantlet is exposed gradually to the environmental condition.

Suspension Culture. In this method of micropropagation, cells or groups of cells are dispersed and allowed to grow in an aerated and sterile liquid culture medium.

Embryo Culture. In the method of embryo culture, the embryo is extracted and placed into a culture medium with proper nutrient in aseptic condition.

Protoplast Culture. In this method, the plant cell is isolated and cultured in an appropriate medium to reform the cell wall and callus. Later, under suitable conditions, the cell develops a cell wall followed by an increase in cell division and cellular differentiation and grows into a new plant [3].

Microclonal reproduction has a number of advantages, the main ones being:

- The speed of obtaining a significant number of clones of one plant. An average of 5-100 clones are obtained from one plant through traditional propagation, while up to several million plants can be obtained through microclonal propagation.
- Recovery of the original planting material, its liberation from bacteria, viruses, nematodes, which is achieved by using only a very small part of the plant - a bud or only a part of it (a group of meristematic cells).
- Ability to propagate plants throughout the year, regardless of the season.
- Small amount of initial plant material required to initiate aseptic culture.
- Independence from weather and climatic conditions, which makes it possible to successfully propagate exotic plants that are difficult to propagate in a climate alien to them without significant effort [6].
- The ability to propagate plants that are difficult to reproduce in natural conditions.
- Significantly smaller areas required for obtaining, selecting and growing plants at the initial stages of reproduction.
- Controllability of growing conditions, easy possibility to change and optimize them.
- Genetic identity of the obtained seedlings and preservation of all valuable varietal qualities.

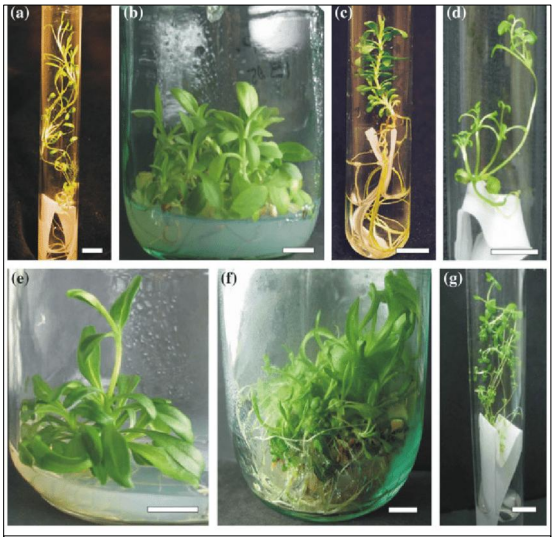
Microclonal reproduction also has certain disadvantages:

- The plants produced are not autotrophic.
- It cannot be implemented in all the crops.
- The plants find a problem acclimatizing to the natural environment.

The process of microclonal reproduction is multistage and includes:

- The selection and preparation of plant explants, which can be different organs, tissues, cells, and seeds of plants;
- The process of sterilization of plant explants and introducing them into culture in vitro;
- Production and cultivation of aseptic plants on a synthetic nutrient medium;
- Microclonal reproduction of regenerative plants;
- Adaptation of microclonal plants to soil conditions, while sterility of received culture plays one of the defining roles; therefore, optimization of parameters of the sterilization stage is of particular importance [2].

This method is widely used both in laboratory practice and in agriculture and related industries, in particular, for the rapid propagation of various fruit, berry, ornamental plant species, etc. For example, in Ukraine, there are many companies engaged in commercial microclonal propagation of certain plant species and varieties: berry (blueberries, strawberries, raspberries and blackberries, currants), fruit (hazelnuts, walnuts, apple rootstocks, etc.), essential oils (mint, oregano, lavender, etc.), and many others [5].



Microclonal propagation of some Gentiana species. a) G. lutea, b) G. punctata, c) G. acaulis, d) G. asclepiadea, e) G. pneumonanthe, f) G. cruciata, g) G. verna. Bars = 1 cm

Scientific research using microclonal plant propagation is conducted by many Ukrainian research institutes and laboratories, including the Institute of Cell Biology and Genetic Engineering of the National Academy of Sciences of Ukraine, botanical gardens (e.g., the M.M. Gryshko National Botanical Garden and the Academician Alexander Fomin Botanical Garden), the Institute of Vegetable and Melon Growing of the National Academy of Sciences of Ukraine, and others. The Institute of Cell Biology and Genetic Engineering of the National Academy of Sciences of Ukraine has created a germplasm collection of plants of the Ukrainian and world flora, which has the status of the National Heritage of Ukraine, and where several thousand plant species are stored, constantly maintained through microclonal propagation and studied [7].

The global market for plants obtained through microclonal propagation is huge. According to some reports, about 507 million tropical ornamental plants are produced annually in this way alone, of which about 150 million are orchids. Microclonal propagation is also actively used for the commercial production of seedlings of the oil palm *Elaeis guineensis Jacq.*, which is a source of

palm oil, date oil and other oils, bananas, various strawberry varieties and many other commercially important plant species.

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УДК 332.12(477)

FEATURES OF THE FUNCTIONING OF FINANCIAL SYSTEMS

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Досліджено особливості функціонування світових фінансових систем та запропоновано модель фінансової системи з урахуванням кризових станів з використанням сучасних технологій.

Ключові слова: *фінансова система, міжнародні фінансові інститути, державні фінанси, фінансові ресурси, фінансовий механізм господарювання, банківська система, комерційний банк.*