



## Micros



*The remnants of the mother micro tuber of the variety Nicola with daughter tubers at ninety days after planting.*

A caterpillar becomes a butterfly. Once people did not even know it was about the same individual. These are only two appearances of the butterfly. A butterfly also lays eggs that when hatched deliver the caterpillars that replaces its skin a few times to allow it to grow. Towards winter they weave a web – a cocoon – in which they pass the winter, go through a metamorphosis and appear as a butterfly next spring to restart the cycle. Four expressions of the same set of genes that allow the species to survive. With the potato crop the lifecycle seems much more simple, only so at first sight surely. When following the same order after pollination the potato flower produces a berry with seeds. This is appearance or phenotype number one. When sown the seed grows into a plantlet which is appearance number two. The plant produces tubers being phenotype three. Three appearances of the plant which are the three means of its propagation. The potato plant itself also is a means of multiplication: when cut up and the cuttings planted they easily root and form a new plant that eventually produces tubers. Like insects also potato has a fourth appearance which is a callus: a group of undifferentiated cells that emanate from a single cell placed in a growth medium. Due to gravitation such callus develops roots that go down and shoots that go up creating the same plant - variety - as the cell was taken from. Occasionally a small aberration occurs leading to some deviation like a different colour of the flower. This so called somaclonal variation may be used by breeders. The expression of

the same potato genome as seed, plant, tuber and callus allows breeders to select a single variety out of up to one hundred thousand of seeds produced in breeding program and basic seed producers to bulk this variety through rapid multiplication programs through cuttings and minituber production in soil culture or soilless culture such as hydroponics. When a rooted in-vitro plantlet is not brought ex-vitro to produce minitubers it may form tubers in the glass or plastic container provided the medium contains sufficient nutrients and the plantlets are subjected to short days, say twelve hour day length: microtubers. This method may be used in scientific laboratories but hitherto no commercial applications on a large scale exist.

Recently I visited the laboratory of Ilan Bio in Tel Aviv where potato microtubers are produced at a commercial scale through a technique of a Temporary Immersion System (TIS). In such a system plant tissue in a closed container is immersed in a nutrient solution for a limited period and then drained. The air of the translucent container of plastic or glass is enriched with carbon dioxide to speed up growth and is illuminated with lamps. This photoautotrophic production process assures a rapid growth of plant tissue mass. When under long day of 24 hours photoperiod no tubers are formed, when placed under short day or darkness the mass stops growing, tubers are initiated and dry matter is transferred from shoot to tubers until the shoots are drained. The company's technology is an IP (intellectual property) trade secret and the company does not publish specific information. I also saw a demonstration of the remarkable vigour of the crop from microtubers grown in early spring at a research station in the Negev with drip irrigation. The photograph shows the remnants of the mother micro tuber of the variety Nicola with daughter tubers at ninety days after planting. The system seems to have the following advantages: many micros per in-vitro plantlet, uniform material as there is only one harvest time, no contamination is possible in the anti-septic conditions of microtuber growth, independence of the growing season so ready on demand, its low costs and future potential to reduce costs further when the process is automated. It is refreshing to note that upstarting innovative potato companies – previously I highlighted true potato seed produced by Solynta – contribute to new developments in the industry. Hopefully they will be brought to fruition and make the crop more efficient and competitive still.

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