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論 文 内 容 の 要 旨
Abstract of Dissertation

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Micropropagation is important for both multiplication and preservation of a wide range of crops, including many food crops. The agricultural sector has been harnessing its advantages in achieving increased crop production. However, recent times have seen a need of innovative improvements in the micropropagation systems since contemporary systems rely significantly on conventional methods. Furthermore, numerous plant species are being revealed to possess medicinal and other valuable properties, but difficult to culture using conventional methods. Therefore, methods that facilitate efficient mass propagation of economically important species have become vital.

Solanum tuberosum L. (potato) is a top global crop species that utilizes tissue culture technology for seed potato production. The work presented in this thesis represents new developments with regard to improved growth medium. Cultivars used in the study were representative of Japanese, European, and Peruvian lines. Enhanced mesos ($CaCl_2$, $MgSO_4$, KH_2PO_4) improved the overall quality of all cultivars, as indicated by longer shoots and larger leaves with dark color, compared with Murashig and Skoog (MS) medium only. Quantitative ion analysis revealed that plantlets with improved overall quality in most cultivars had increased calcium, magnesium, potassium, and phosphorus uptake than plantlets on MS. However, a marked decrease in iron uptake by plantlets was revealed on 3.0× MS, compared with the uptake on 2.0× or 2.5 × MS. The iron uptake on 3.0× MS was even lower than that on 1.0× MS in most cultivars. The study revealed for the first time that enhanced mesos in MS medium, complemented by enhanced calcium, magnesium, potassium, phosphorus, and iron uptake, play a significant role in improving the micropropagation of potato.

Successful micropropagation of medicinal plant species is significant in utilizing their valuable properties, but is difficult to achieve for numerous species. Efficient cultivation systems of such species inevitably require effective micrcopropagation methods. The work presented in this thesis represents new methods and developments for the micropropagation of *Polygonatum macranthum* (Maxim.) Koidz, and *Glyzyrrhiza uralensis* (Fisch.). Seed germination of *P. macranthum* was achieved within nine weeks when seed surface sterilization utilized Sirvip™, an antimicrobial composition, in contrast to 19 months taken under natural conditions. Supplementing the 1/2 MS medium with cytokinin BAP at the concentration of 1.0 mg l^{-1} proved to be effective for microrhizome propagation. Results present a new cultivation system for the rare plant species *P. macranthum*. Surface sterilization of stem explants of *G. uralensis* using a colloidal solution of silver nano particles (Nanopure™) and Sirvip™ yielded survival rates of 91.1% and 70.8% respectively, compared to 17.2% and 16.1% obtained with the conventional sterilants NaOCl 1%(w/v) and 2%(w/v). The results comprise the first report of *G. uralensis* micropropagation through direct shoot regeneration.

This thesis presents effective novel methods for culturing difficult-to-propagate species of economic importance that could facilitate their mass propagation.