

enough for chemical pinching of these clones and the application of this PGR did not affect the morphology of flower organs, but affected the flowering time. The PGR-treated mums flowered several days later than the untreated (control) plants. We now intend to release these new mums for gardening and potted-mum production.

Production of Tubers in Cyclamen from Somatic Embryos[®]

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The Problem and Difficulties in Cyclamen Breeding. *Cyclamen persicum* is one of the most popular pot plants in Japan. Up to now many seed-propagated cultivars of cyclamen have been bred in Japan, but only a few cultivars are registered in Plant Breeders Right program in Japan. In general, there are three major reasons why the number of registered cultivars is small.



Figure 1. Cyclamen microtubers produced directly from somatic embryo.



Figure 2. Flowering occurred about 10 months after germination of the microtubers.

- Cyclamen is hard to keep uniform as a cultivar and that makes it difficult in PBR registration.
- It takes a long time in the breeding process because one generation, from pollination to bloom, takes almost 2 years.
- Cyclamen tends to develop inbreeding depression and sterility by inbreeding.

These reasons are a big obstacle in the development and registration of cyclamen cultivars.

The Present Condition of Clonal Cyclamen Cultivars. Currently some clonal cyclamen cultivars propagated by tissue culture have been commercialized in Japan. Those cultivars show good uniformity, however, quantity is limited because the high cost of tissue-cultured seedlings limits their quantity in the market.

The Production of Cyclamen Microtubers by Tissue Culture. We attempted to make cyclamen microtubers directly from somatic embryos by tissue culture and obtained them (Fig. 1). The tubers are about 5 mm in diameter and started germination 1 week after planting in a greenhouse under proper temperature and humidity conditions. Flowering occurred about 10 months after germination (Fig. 2). It is possible to produce 10,000 tubers from one leaf in 1 year.

Utilization in Cyclamen Breeding. Ordinary breeding methods with cyclamen require more than 10 years; using this micropropagation system for cyclamen tuber

production, we think it is possible to breed clonal cyclamen cultivars within 3 years from the initial cross. It seems to be possible to propagate sterile cultivars, for example, from interspecific hybridization.

We think this method is very useful in commercial production as well as plant breeding as it is possible to reduce the production cost of microtubers when compared with F1 seed production by hand pollination.

New Cyclamen Cultivar 'Prologue' by Micropropagated Tuber. We hybridized a new cultivar, 'Prologue', of *C. persicum* (Fig.3) and propagated it by the micropropagated tuber method. 'Prologue' is a clone of a selected single plant, resulting from a hybrid between 'Victoria' (a tetraploid) and a white tetraploid inbred selection of our own. The flower of 'Prologue' is a bicolor with fringed petals like 'Victoria', however the color of the edge and base is a delicate purple instead of the reddish purple of 'Victoria'. In addition, 'Prologue', shows heterosis as compared with 'Victoria' which shows inbreeding depression.



Figure 3. *Cyclamen persicum* 'Prologue' a new cultivar we hybridized.