Nattapong Chanchula 2015: Biotechnological Techniques for Improvement of Native Torenia and Their Hybrids. Doctor of Philosophy (Horticulture), Major Field: Horticulture, Department of Horticulture. Thesis Advisor: Associate Professor Thunya Taychasinpitak, M.S. 114 pages.

Torenia is considered as an important economic pot plant in Japan. Sterile or less fertile pollen occurred after interspecific breeding, so F1 pollen could not be used to breed. Hence, the objective of this experiment was to induce tetraploid and mutant induction by biotechnology techniques. Axillary buds (1 node cuttings) of new Thai native *Torenia fournieri* Lind. were exposed to acute (Cs-137) gamma ray irradiation at 0, 20, 40, 60, 80 and 100 grays. The results showed that GR_{50} was 68.83 gray, so axillary buds from the selected mutated plants from the first generation were then irradiated again at 0, 60, 65, and 70 grays. Morphological screening for mutations revealed 3 mutated phenotypes (pink, dark and wavy shaped flowers). Genetic variation was analyzed by HAT-RAPD technique. Polymorphisms revealed by the D30 and F29 random primers could be used to differentiate between the samples, but chromosome numbers (2n=2x=18) were not changed when the chromosome were observed by fluorescence *in situ* hybridization (FISH) analysis. The pollen of some mutants (wavy flower shape) was sterile. The plants with pink, dark and wavy petals were selected for possible development of new cultivars. Leaves were cut from F1 hybrids of *Torenia* for the different treatments. The petioles were soaked in 15 mgl^{-1} colchicine solution for 0, 12, 24, 48 and 72 h (32 leaves per treatment), after which they were placed upright in peat moss for rooting. The survival rate decreased when treatment duration was increased. The results showed that tetraploidy was induced in 3 clones from *T. asiatica* x *T. ranongensis*, 15 clones from *T. bentamiana* x *T. asiatica*, 24 clones from *T. asiatica* x *T. pierriana* and 18 clones from *T. fournieri* x *T. asiatica*. The leaf explants cultured on MS medium with Picloram added at every concentration tested formed soft, loosely aggregated callus tissue. Callus tissue was induced from leaves of diploid *Torenia* to the greatest degree (95 % callus formation at 3 weeks). For polyploid *Torenia*, the highest percentage of callus formation (92.5 %) was observed on leaves cultured on MS medium containing Picloram at the rates of 1.0 and 1.5 mgl^{-1} for 3 weeks in the dark. Following transfer of the embryogenic callus tissue to hormone-free MS medium under light conditions (16-h photoperiod), the greatest rate of somatic embryo formation was observed in the callus derived from the 1.5 mgl^{-1} Picloram treatment, in the case of both diploid and polyploid *Torenia* accessions. The LD_{50} were 63.65 grays in diploid plants and 72.00 grays in polyploid plants from tissue culture.

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