Improving *Hemerocallis* (Daylily) breeding techniques using Diploid and Tetraploid conversions

Daylilies (*Hemerocallis)* are a very valuable ornamental herbaceous landscape plant utilized for their easy culture and long flowering period. To continue to expand on the available flower shapes and colors, daylilies have been extensively hybridized. Daylilies were first converted from diploids to tetraploids in 1947. Since then, there have been tremendous advancements in flower traits in both diploid and tetraploid breeding lines. The conversion of diploids to tetraploids has allowed for even further improvements in current tetraploid breeding due to the introduction of new genetic traits. In this research, several different conversion methods were examined to further refine and apply previously published techniques to daylilies. One method of converting tetraploids to diploids (anther culture), was investigated, while two methods of diploid to tetraploid conversion were also studied (scape injection and conversion in tissue culture). In anther culture, buds measuring about a centimeter in length were removed from a tetraploid daylily cultivar, and under aseptic conditions had their immature anthers removed and placed onto a callus culture medium. The callus culture was initially held at 4^{O}C for 3 days as a temperature shock treatment, and then moved to 25^{O}C for further incubation. Unfortunately, no viable callus has resulted from this technique. With the scape injection method, either a 1% or 5% solution of colchicine in either a 1 mL or 5 mL volume was gradually injected into a developing floral scape over a period of 48 hours. The third method examined was by attempting conversions of diploid daylily buds to tetraploids using callus culture techniques. After callus formation, the callus was placed onto a medium containing colchicine for 3 days in the light, and then transferred to a shoot induction medium. To date, no sustainable callus cultures have been generated using this culture technique. Scape injection has resulted in the formation of multiple converted scapes (One with 5mL of colchicine, and two with 1 mL of a colchicine, kinetin, DMSO solution). On many treated scapes the floral buds aborted, however, on those that did not, bud retention appeared to be more dependent on the age of the scape as opposed to the volume or concentration of the colchicine application. Scapes that were just emerging when injected had floral buds that survived the conversion process, whereas buds on older scapes typically aborted after 7-10 days. Those scapes injected with the solution containing colchicine as well as kinetin and DMSO, produced multiple scapes as compared to plants injected solely with colchicine. Further investigation on the affects of kinetin and DMSO on scape production needs to be conducted.