Mutagenic influences of colchicine on phenological and molecular diversity of *Calendula officinalis* L.

Y.I. El-Nashar\(^1,2\) and M.H. Ammar\(^1,3\)

\(^1\)Plant Production Department, College of Food and Agriculture Sciences, King Saud University, King Saudi Arabia
\(^2\)Ornamental Plants and Landscape Gardening Research Department, Horticultural Research Institute, Al-Montaza Garden, Giza, Egypt
\(^3\)Rice Research and Training Center, Sakha, Kafr El-Sheikh, Egypt

Corresponding author: Y.I. El-Nashar
E-mail: yelnashar@ksu.edu.sa

Received September 29, 2015
Accepted January 15, 2016
Published April 26, 2016
DOI http://dx.doi.org/10.4238/gmr.15027745

**ABSTRACT.** Six different colchicine concentrations: 0, 400, 800, 1200, 1600, and 2000 ppm, in combination with four soaking time treatments (1, 2, 3, and 4 h), were selected to assess the effects on germination, vegetative growth, and flower yield components in calendula plants. The molecular diversity among the treatments was assessed using ten SRAP marker combinations. Seed soaking in colchicine significantly enhanced both the fresh and the dry shoot and root masses, flowering date, number of flowers per plant, and flower diameter. At 1200-ppm colchicine combined with a 4-h soaking time, a superior effect on seed germination was observed, whereas 800 ppm for 4 h produced the highest number of flowers and the largest flower diameter. The earliest flowering time was found at 800 ppm combined with a short soaking time (1 h), while the 4-h soaking time with 800 ppm, is recommended for growing calendula outdoors, since it enhances flower development. At the molecular level, 752 fragments were successfully amplified...
using the SRAP primers, with 280 genetic loci found throughout the calendula genome. The polymorphism percentage ranged from 79 to 100% and the polymorphic information content (PIC) values ranged between 0.85 and 0.97. The high number of detected loci and PIC values suggests a great power of SRAP markers in detecting mutant molecular diversity. Our results clearly show the existence of genetic variation among colchicine treated calendula plants and the clustering of the studied mutants was concordant with the colchicine concentration used.

**Key words:** Calendula; Colchicine; Mutation; Flowering yield; Molecular diversity; SRAP