

The Effects of Ethyl Methanesulphonate and Sodium Azide on Growth in 'G.G.Gerbing' azalea (Rhododendron)

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Introduction

- *Mutagens* have become an important tool in generating new variability that can be used to improve yield and quality in many crops and ornamental plants.
- *ethyl methanesulphonate (EMS)*, and *sodium azide (SA)* have been the most commonly used mutagens in plant breeding programs, primarily because of the fact that they do not disturb desirable attributes in plants.

Objectives

The main objective of the experiment is to determine the effectiveness and optimum doses of chemical mutagens to induce the changes of growth and physiology responses in azalea.

Materials and Methods

- ❖ 'G.G.Gerbing' azalea plants procured from Magnolia Gardens Nursery, Magnolia, TX, were transplanted in 6 inch pots filled with Berer growing media on 16 Dec. 2015 in an unshaded greenhouse at College Station, TX.
- ❖ The treatment, uniform, disease and pest free plants were selected. Each pot should contain 6 buds, and the extra buds were manually removed.
- ❖ Total of 126 plants were selected, the buds (was wrapped by the absorbent cotton) of these plants were treated with EMS and SA-solutions prepared in 0.1 M phosphate buffer adjusted to pH 7.4 and pH 3.0, respectively. The treatment concentrations, viz., 30 mM, 60 mM, 90 mM, 120mM and 150 mM of EMS and 2 mM, 4 mM, 6 mM, 8 mM and 10 mM of SA.
- ❖ During the establishment stage, plants were irrigated as needed using a nutrient solution containing 200 mg·L⁻¹ 21N-7P-7K and reverse osmosis water.
- ❖ Environment: 40.9°C day/24.2 °C night; 24.9% RH; 22.6 mol·m⁻²·d⁻¹ DLI.
- ❖ Measured parameters in Exps: Visual rating of buds, new buds height, new leaf number, aberrant leaf and chlorophyll content.

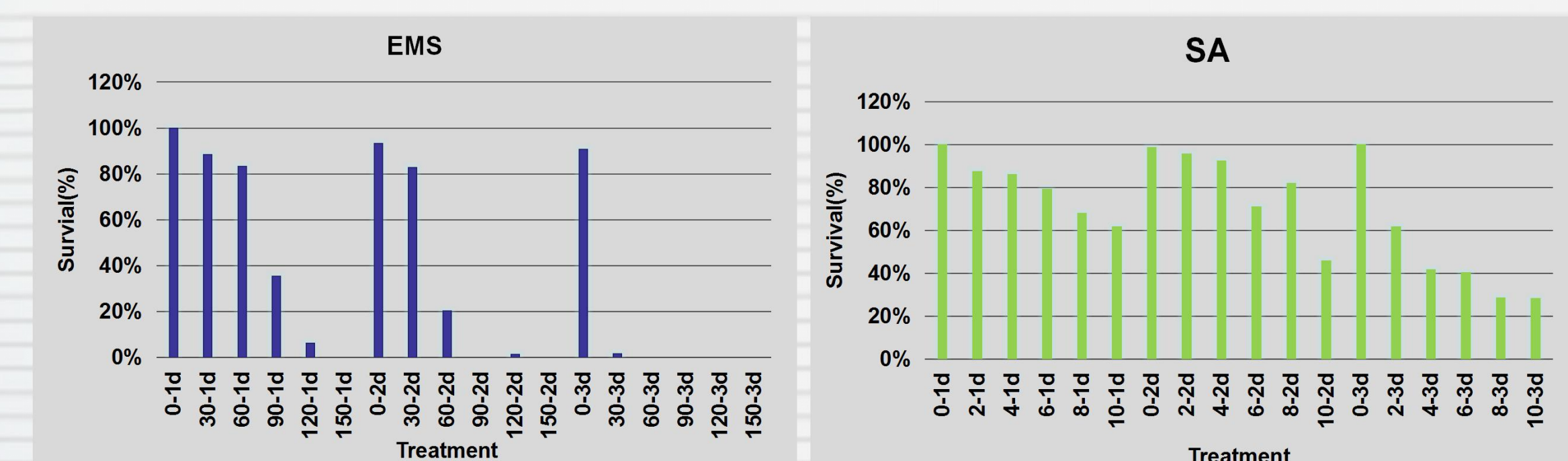


Figure 1. The survival rate of EMS and SA treatment.

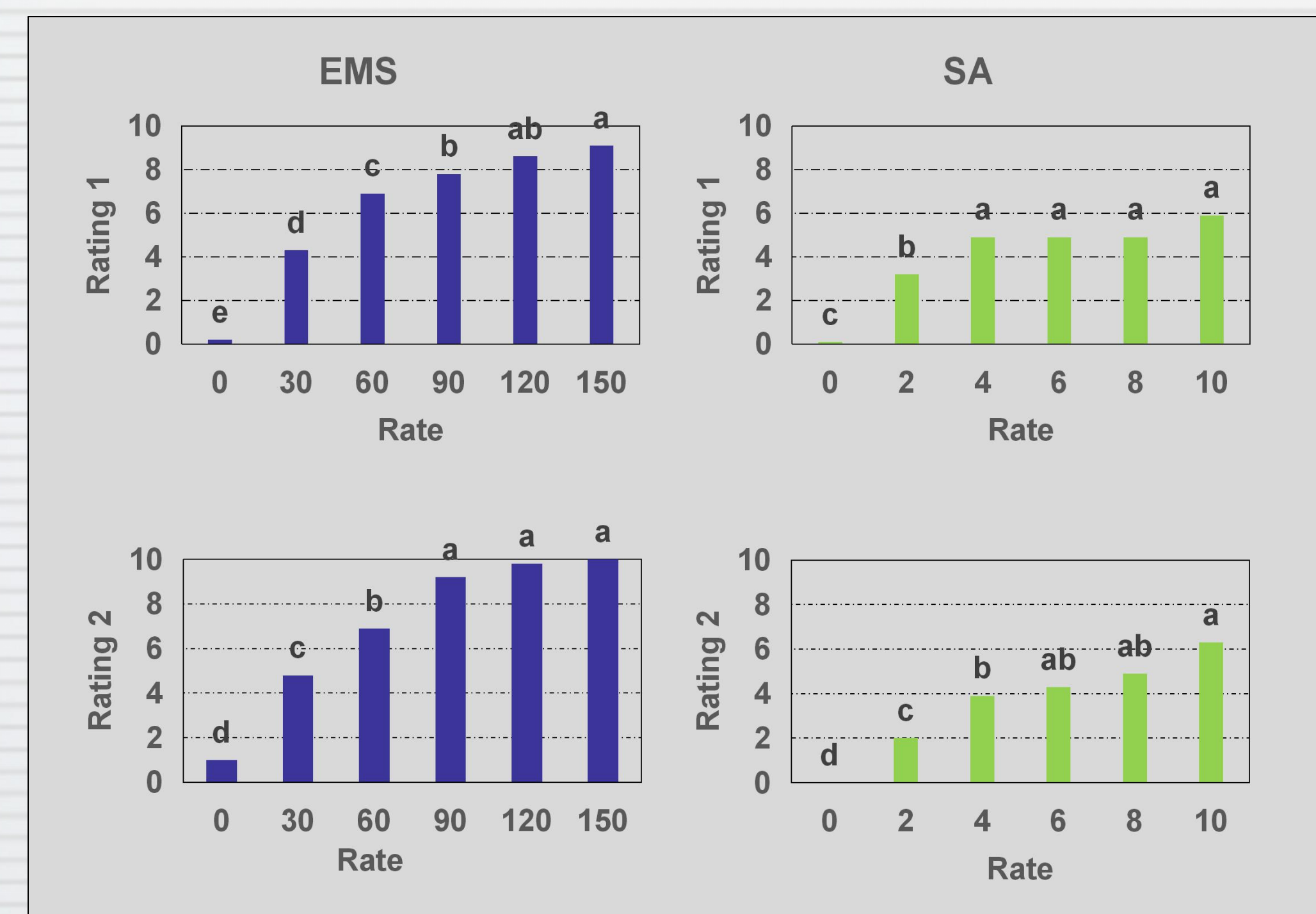


Figure 2. Responses of rating score among EMS and SA treatment solution.

Mutagen	Time	h1	h2	h3	h4	l1	l2	l3	l4
EMS	1d	0.6b	4.6b	7.8a	9.6a	3.1a	10.3a	14.6a	18.2a
	2d	0.9a	5.9a	8.8a	10a	3.6a	11.3a	15.9a	18.6a
	3d	0.5b	2.9c	5.5b	6.3b	0.35a	6.3b	11.8b	17a
SA	1d	1.1b	6.5a	10.4a	20.1a	3.4a	10.8a	15.5a	11.7a
	2d	1.3a	6.3a	9.3ab	18.7a	3.9a	11.3a	14.8a	10.3a
	3d	0.9b	4.9b	8.7b	18.6a	3.4a	9.4b	14.5a	10.3a

Table 1. Responses of height and leaf number among different EMS and SA treatment time.

Mutagen	Rate	h1	h2	h3	h4	l1	l2	l3	l4
EMS	0	0.9b	4.7a	8a	9a	4ab	9.9a	15.2a	17.6a
	30	0.7bc	5.4a	7.9a	10.1a	3.8ab	10.1a	14.3a	19.5a
	60	0.5bc	4a	6.9a	8.3a	2.5bc	9.9a	13.6a	17.8a
	90	0.2b	3.2a	7.8a	11a	1.7c	9.8a	13.3a	18.5a
	120	1.6a	3.5a	9.3a	7.3a	5a	7a	17a	16a
	150	-	-	-	-	-	-	-	-
SA	0	1a	5.6ab	9.9a	12a	3.7ab	10.1a	15.1a	20.1a
	2	1.1a	5.01b	7.9a	8.7b	3.3ab	10.5a	14a	18.3a
	4	1a	5.9ab	9.1a	10.8ab	4.3a	11.1a	15.1a	18.8a
	6	1.2a	6.6a	10.5a	11ab	3.5ab	10.6a	15.4a	18.7a
	8	1.2a	7a	10.6a	11.3ab	3.1b	11.6a	15.8a	18.9a
10	1.3a	6.9a	10.4a	11.6ab	3.4ab	10.3a	14.9a	20.8a	

Table 2. Responses of height and leaf number among different EMS and SA treatment solution.

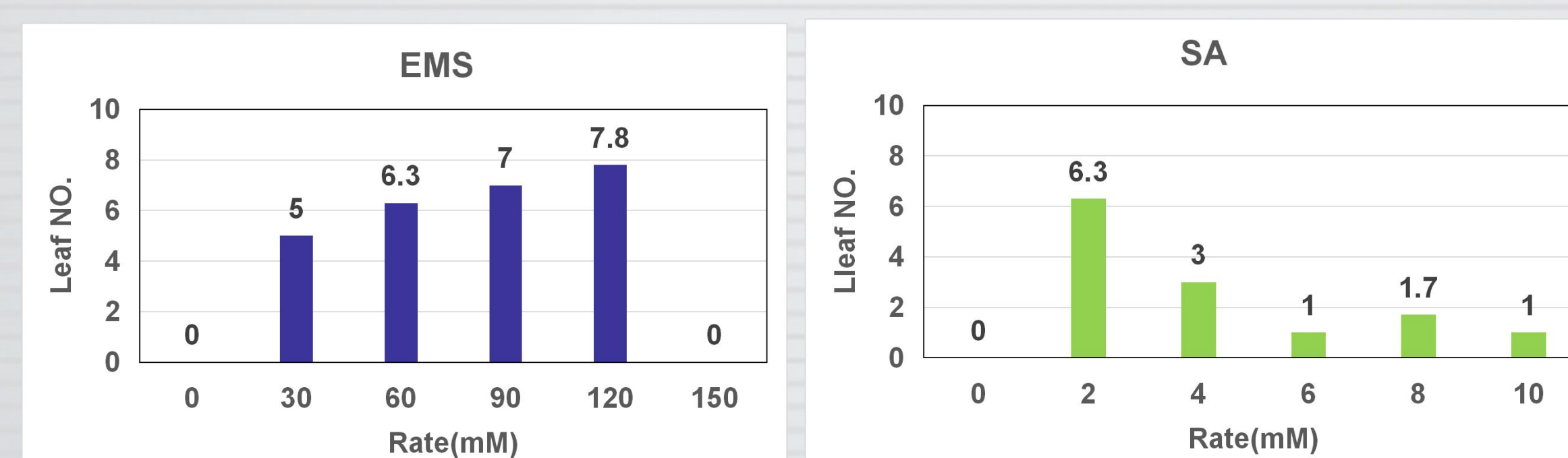


Figure 3. Responses of abnormal leaf number among EMS and SA treatment solution.

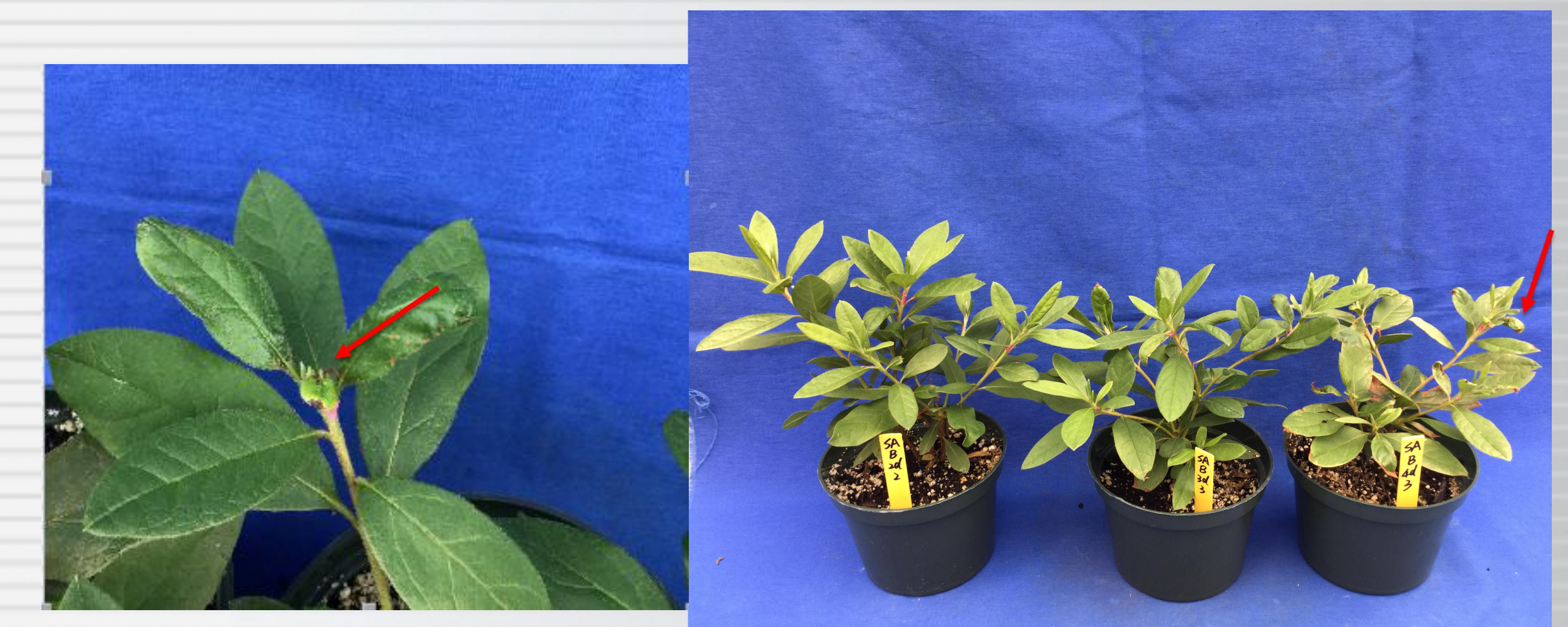


Figure 4. The abnormal bud and abnormal leaves.



Figure 5. The standard of rating.

Results

- The median lethal dose (LD50) is about 60-90 mM for EMS and 8-10 mM for SA.
- Plants treated with 60, 90 mM EMS or 8-10 mM SA have the medium visual damage rating score. This rating result further confirms the LD50 conclusion.
- The average of height and leaf number between LD50 condition and control are similar. The ANOVA test shows no significant difference, this may be caused by the mutagen enlarging the in-group variation.
- As the abnormal leaf number of SA decreased from 6.3 (2mM) to 1 (8mM), EMS increased from 5 (mM) to 7.8 (120mM).
- There was no significant difference of chlorophyll content, branch number among all EMS and SA treatment solutions (data not shown).

Conclusion

- Plants can be tested with EMS at a rate up to 90 mM for 2d, and with SA at a rate up to 10 mM for 3d as the optimum doses of chemical mutagens.
- This is just the preliminary experiment results, after flowering, the flower number, flower size, flower color data will help further optimize the doses of EMS and SA mutagens.