Seed Germination Response of *Medicago Rigidula* and *Medicago Polymorpha* to KNO3, Gibberellic Acid, Sulfuric Acid, and Polyethylene Glycol

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Abstract— In order to investigate of seed germination of annual medics under different gibberllic acid and sulfuric acid concentration and potassium nitrate and polyethylene glycol osmotic potential four experiments were conducted. The result showed that all methods broke seed dormancy and exhibited seed germination of annual medics, but some case was different in cultivars. The most effective and practical method for seed dormancy breaking in *Medicago rigidula* was 98% sulfuric acid application for 2 min. The main advantages of this method were speed, ease of use and unaltered physical condition of the seeds following treatment and cheap. Polyethylene glycol (PEG 4000) had significant effect on germination percentage. Seed germination of *Medicago rigidula* and *Medicago polymorpha* was 10.8% more than control under this treatment. The highest germination percent belonged to M. rigidula under 0.7 bar Polyethylene glycol treatment and had 10% more germination than control. M. polymorpha had highest seed germination percent under 0.9 bar Polyethylene glycol treatment and had 15% more germination than control. The lowest seed germination was belonged three species that treated with distilled water considered as control.

Keywords---Dormancy, gibberllic acid, sulfuric acid, Potassium Nitrate, polyethylene glycol.

I. Introduction

PHYSIOLOGICAL dormancy is indicated when an increase in germination rate occurs after an application of gibberellic acid (GA3) or after Dry after-ripening or dry storage. It is also indicated when dormant seed embryos are excised and produce healthy seedlings: or when up to 3 months of cold (0-10°C) or warm (=15°C) stratification increases germination: or when dry after-ripening shortens the cold stratification period required. In some seeds physiological dormancy is indicated when scarification increases germination (1).

Seed priming (osmoconditioning) has been used to improve vegetable and ornamental seeds performance by increasing the speed of germination as well as improving germination seed uniformity (3). Priming can also help seeds overcome environmental stresses such as germination under extremely high temperatures or salt and water stress (2).

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The objective of the present study was to find more efficient ways to break seed dormancy of two annual medics (*Medicago rigidula* and *Medicago polymorpha*)

II. Material and methods

Four experiments were conducted to evaluate seed germination of annual medics including *Medicago rigidula* and *Medicago polymorpha*. The experimental design in all experiments was a factorial with treatments organized following a completely randomized block design, with four replications. Pods were handpicked and half of them were hand separated from the pods and stored in paper bags at room temperature (25 °C) until germination tests were performed.

The statistical method used in the present experiment was one-way analysis of variance performed by using MSTATC (4) and Excell with four replications. Differences between mean values were evaluated for significance by Duncan's Multiple Range Tests at $p \leq 0.01$. (5).

III. Results and Discussion

There were significant differences on germination percentage and germination rate affected by gibberellic acid.600 ppm gibberellic acid in compared with other gibberellic acid concentrations was the most effective on making the hard coat penetrable and also on seed germination rate of M. polymorpha. This hormone increased germination percentage of three annual medics from 55% in control to 87% (Table 1) .The least germination percentage was observed in control (Table 1).

Sulfuric acid was also effective in reducing hardseededness but at the highest concentration (98%) and the shortest time (2 min) in seeds of M. rigidula (Table 2). Sulfuric acid with 98% concentration increased seed germination percent from 54% in control to 81.65% in treated seeds of M. rigidula and had more seed germination percentage than M. polymorpha under different sulfuric acid concentration levels. Seeds apparently damaged were observed at the two lowest concentrations (Table 2). Germination rate was not affected by Sulfuric acid concentration.

Sulfuric acid had significant effect on *M. rigidula* with 98% concentration and 2 minutes. But *M. polymorpha* had low germination percentage with differen concentration of

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sulfuric acid. Because the coat of these species were narrow and the embryo injured by sulfuric acid. Treating *Sesbania rostrata* seeds with concentrated H_2SO_4 for 10 min increased germination as *M. rigidula*. Preventing of germination of *Calligonum* species has ecological advantages (7).

Potassium nitrate had significant effect on germination percentage of *M. rigidula* and *M. polymorpha*. Seed germination of *M. rigidula* was 27% more than distilled water in -0.5 bar osmotic potential. Nitrate promoted germination of dormant seeds of the two species. these result supported by singh (7) that reported seed germination could be enhanced by potassium nitrate solute on plant seeds that had seed dormancy. Thomas (9) describes a model of physiological process controlling germination in which nitrate is required for germination. Therefore, a higher amount of available nitrate would promote germination.

Polyethylene glycol (PEG) had significant effect on germination percentage of *M. rigidula* and *M. polymorpha*. Polyethylene glycol promoted germination of dormant seeds of the three species in low osmotic potential. Seed germination of *M. polymorpha* was 15% more than distilled water in -0.9 bar osmotic potential. Drought stress in low concentration of PEG had positive effect on germination percentage of dormant seeds. Because of reduce synthesis of some amino acid that inhibiting germination (6). But at high concentration of PEG the rate of synthesis of protein and transportation of material become low and inhibiting germination (8).

REFERENCE

[1] Afzal J.A.,C.Cirak , 2006. The effects of light and some presoaking treatment on germination rate of medics seeds 8:188-190

[2] Basra, S.M.A., I. Afzal, R.A. Rashid and A. 2005. Inducing salt tolerance in wheat by seed vigor enhancement techniques. Intl. J. Biotechnol. Biol., 1: 173-179

[3] Basra, S.M.A., M. Ashraf, N. Iqbal, A. Khaliq, and R. Ahmed. 2004. Physiological and biochemical aspects of presowing heat stress on cotton seed. Seed Sci. Technol. 32: 765-774. http://dx.doi.org/10.15258/sst.2004.32.3.12

[4] Reginato, R.J., 1993. Field quantification of crop water stress. ASAE, 26: 772-775.

[5] Rehman, S., P.J.C. Harris and W.F. Bourne. 1998. Effect of pre-sowing treatment with calcium salts, potassium salts or water on germination and salt tolerance of *Acacia* seeds. J. Plant Nutrition, 21: 277-285. http://dx.doi.org/10.1080/01904169809365402

[6] Rozbeh Farhoudi and Farzad Sharifzadeh. 2006 The effects of NaCl priming on salt tolerance in canola (*Brassica napus* L.) seedlings grown under saline conditions.Indian J. Crop Science, 1: 74-78

[7] Singh, B.G., 1995. Effect of hydration-dehydration seed treatments on vigour and yield of sunflower. Indian J. Plant Physiol, 38: 66-68.

[8] Subedi K. D. and B. L. Ma. 2005. Seed Priming Does Not Improve Corn Yield in a Humid Temperate Environment. Agron. J. 97:211–218

[9] Thomas, P., 1986. Canadian canola production. In: K. Kephart (ed.), pp: 6– 16. Pacific Northwest Winter Rape Seed Production Conf., Moscow, ID. 24-26 Feb., Crop. Ext. Ser., Univ. of Idaho, Moscow

TABLE I
.MEAN GERMINATION PERCENTAGE, GERMINATION RATE (MGT), SEEDS WITH PODS AND SEEDS WITHOUT PODS IN M. RIGIDULA AND M. POLYMORPHA UNDER GIBBERELLIC ACID CONCENTRATION.

Treatments	Germination mean (%)	MGT (days)	seeds with pods%	seeds without pods%
M. rigidula				
200ppm	**59c**	**10a**	**55c**	**57c**
400ppm	**62b**	**10a**	**59b**	**61b**
600ppm	**73a**	**10a**	**70a**	**72a**
Control	**55c**	**10a**	**51c**	**53c**
M. polymorpha				
200ppm	**60.3c**	**7b**	**57.5c**	**59.5c**
400ppm	**75.9b**	**7b**	**72b**	**73.7b**
600ppm	**87a**	**5b**	**81.8a**	**84a**
Control	**56c**	**10a**	**52c**	**54c**

Means at each column followed by similar letters are not significantly different at $p \leq 0.01$

TABLE II
MEAN GERMINATION PERCENTAGE, GERMINATION RATE (MGT), SEEDS WITH PODS AND SEEDS WITHOUT PODS IN M. RIGIDULA AND M. POLYMORPHA UNDER SULFURIC ACID CONCENTRATION.

Treatments	Germination mean (%)	MGT (days)	seeds with pods%	seeds without pods%
M. rigidula				
50%×5 min	64c	10a	60c	63c
80%× 2 min	73b	10a	69b	72b
98%× 2 min	81.65a	10a	76a	80a
Control	54d	10a	49d	51d
M. polymorpha				
50%×5 min	32c	10a	30c	31c
80%× 2 min	39b	10a	33b	37b
98%× 2 min	44.7b	10a	40.5b	42b
Control	55a	10a	50.5a	53a

Means at each column followed by similar letters are not significantly different at $p \leq 0.01$.