Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(5): 599-602
Received: 28-07-2019
Accepted: 30-09-2019

Vitnor Sushil S
Department of Agriculture Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Wagh RS
Department of Agriculture Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Pagire Gaurav S
Department of Agriculture Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Jadhav GN
Department of Agriculture Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Sawant PP
Department of Agril. Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Correspondence
Vitnor Sushil S
Department of Agriculture Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Assessment of genetic variability of wheat for early establishment under moisture stress condition by using PEG

Vitnor Sushil S, Wagh RS, Pagire Gaurav S, Jadhav GN and Sawant PP

Abstract
An experiment was conducted to study "Assessment of genetic variability of wheat for early establishment under moisture stress condition by using PEG" was carried out at P.G.I. phytotron, Department of Agricultural, Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (MS) India during the year 2015-2017.

This study was carried out in one experiment. The first experiment was laid out in factorial completely randomized design with three replications involving fourteen wheat genotypes and five PEG concentrations (0, -0.1, -0.3, -0.5 and -0.7 MPa) at phytotron, Department of Agril. Botany, M.P.K.V., Rahuri. The germination percent, seedling vigour, and germination stress index were recorded on 2nd, 4th, 6th and 8th day and the shoot, root and seedling length as well as dry weight were recorded on 8th day. The data revealed significant genetic variation for moisture stress tolerance existed in tested wheat genotypes. The osmotic potential reduced all the recorded parameters. The shoot length affected more than the root length. At -0.1 MPa osmotic stresses condition some genotypes showed increased in shoot and root length. Dry matter accumulation was significantly affected by moisture stress conditions. The maximum germination percentage, seedling vigour and germination stress index was recorded in NIAW-3170 genotype, while the genotypes HD- 2189, NIAW-3173, NIAW-3212 recorded minimum values under higher osmotic stress conditions (-0.5 and - 0.7 MPa). The genotypes NIAW-3170 and NIAW-3166 recorded maximum shoot length and their stress tolerance index under higher osmotic stress condition,

The genotypes considering root length and their stress tolerance index, among the all genotypes maximum values were recorded in NIAW- 3170 was recorded maximum mean Root Length followed by NIAW-1415 and minimum Root Length was recorded in NIAW-3166. Among all the genotypes the maximum dry matter was recorded in the genotypes NIAW- 3170 followed by genotypes NIAW- 3220 whereas minimum dry weight was recorded in NIAW-3212 and HD-2189 in the higher osmotic stress coditions.

Keywords: Micro moles, genotypes, phytotron, osmotic stresses, polyethylene glycol

Introduction
Wheat (*Triticum aestivum* L.) is the staple food crop of the world and second important crop of India after rice. Its productivity and yield are significantly influenced by selection of suitable varieties, soil and environmental conditions. In present situation most of the wheat growing areas comes under drought (moisture) stress. Many of the researchers reported that the stress is individual effect and they caused significant effect on plant growth and development. But most of the plants have different adaptive mechanisms for coping up with stress. Out of which one or more than one mechanism exist for adaptation stress condition. To improve our present knowledge about stress tolerance, we need to screen wheat genotypes by using different screening techniques. The study of impact of different screening techniques and measured parameters will assist in identifying some selection criteria that might prove useful in developing moisture stress tolerant genotypes. Considering all these aspects, present investigation entitled "Assesment of genetic variability of wheat for early establishment under moisture stress condition by using PEG." was carried at Post Graduate Institute Farm, Department of Agricultural, Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (MS) India during the year 2016-2017.

Objectives
1. To test the germination ability of wheat genotypes for stress by using PEG 6000.
2. Assessment of genetic variability under induced moisture stress by using PEG 6000.

Material and Methods
Design: Factorial Completely Randomized Design (FCRD)
Replication: Three (3)
Season: Kharif, 2016

Genotypes:

Table 1: List of genotypes

1.	NIAW-3056	7.	NIAW-3161	13. NIAW-1415
2.	NIAW-3170	8.	NIAW-3173	14. NIAW-1994
3.	NIAW-3212	9.	NIAW-3166	
4.	NIAW-3217	10.	NIAW-3183	
5.	NIAW-3220	11.	NI-5439	
6.	NIAW-3033	12.	HD-2189	

Table 2: PEG Concentration

(Control)- (Distilled water)	-0.1 MPa (78.49 g/l)
- 0.3 MPa (151.02 g/l)	- 0.5 MPa (202.13 g/l)
- 0.7 MPa (243.49 g/l)	

Experimental Results
Persentage Germination at 8th day
Under non stress (0 MPa) condition germination percentage at 8th day, among the genotypes, NIAW-3217, NIAW-3173 and NIAW-3183 recorded 100% germination. While the genotypes NI-5439 and NIAW-3161 recorded 98.88%, 98.30% respectively. At-0.1 MPa stress condition, percent germination percentage at 8th day, genotype NIAW-3170 reported maximum germination percentage (99.96%) and minimum per cent germination was noted in HD-2189 (90.51%).The -0.3 MPa osmotic stress condition showed slightly decreased in germination percentage at 8th day some of the genotypes like NIAW-3183 (100%), NIAW-3170 (98.00%) recorded maximum and NIAW-3166 (76.06%) recorded minimum germination percentage. At -0.5 MPa osmotic stress condition, At 8th day genotype NIAW-3183 (93.07%), NIAW-3170 (92.97%) reported the highest germination percentage whereas, lowest germination percentage (62.84%) was noted in NIAW- 3033.Germination percentage was adversely affected at -0.7 MPa osmotic concentration. At 8th day the genotype NIAW-3173 recorded 4.48% germination, respectively. At 8th day most of the genotypes viz., NIAW-3217, NIAW-3173, NIAW-3183 recorded 100% germination. While the genotypes NI-5439 (98.88%), NIAW-3161(98.30%) recorded germination. In present study diverse genetic differences were found among the genotypes with respect to germination and there was substantial decline germination in all wheat genotypes. The genotypes responded differently to various osmotic stress levels. (Gao *et al*., 1999).

Shoot and Root length at 8th day (cm)
Data regarding effect of osmotic stress on shoot length of different wheat genotypes showed statistically significant results and presented in Increases osmotic potential led to an increase in shoot length only at -0.1 MPa in some genotypes, but later on it decreased in all genotypes with increasing osmotic potential. The mean shoot length was 8.79, 3.70, 2.11, 1.51 and 0.67cm under 0, -0.1, -0.3, -0.5 and -0.7 MPa osmotic potential of stress conditions, respectively.
Under controlled condition the genotype NI-5439 (11.08 cm) recorded maximum shoot length followed by NIAW-3161 (10.34 cm) whereas, minimum shoot length was noted in NIAW-3173 (6.91 cm) and NIAW-3056 (7.11 cm).
Data indicated that increase in osmotic stress caused a significant decrease in root length except -0.1 MPa osmotic stress. The mean root length was 5.78, 4.25, 3.76, 3.05 and 2.16 cm under 0, -0.1, -0.3, -0.5 and -0.7 MPa stress conditions respectively.
Under controlled condition the genotype HD-2189 (8.59 cm) recorded maximum root length followed by NIAW-1994 (8.21 cm) and NIAW-3170 (6.96 cm). While, the minimum root length was recorded in genotypes NIAW-3161 (4.14 cm) and NIAW-3183 (4.31 cm).
Shoot length, root length and total seedling length were discussed here, it seems that, PEG concentration (drought stress) affects seed germination via limitation of water absorption by seeds (Fraser *et al*., 1990) , creation of disorders in protein synthesis finally resulted in decline in seedling length. The reduction in the shoot and root length might be due to an impediment of cell division and elongation, leading to a kind of tuberization. This tuberization and lignifications of the root system allow the water stress plant to enter a slow-down state, while waiting for the conditions to become favourable (Fraser *et al*., 1990). Badiane *et al*. (2004). Concluded that the expression of certain genes controlling root formation is stimulated by drought conditions which indicated a promising role of some dominant drought tolerant genes in wheat varieties which developed a decent root system under water deficit conditions.

Dry weight at 8th day (g)
The data showed statistically significant results and furnished .At non stress condition, the genotypes NIAW-3033 and NIAW-1994 recorded maximum dry weight (0.031 g) and the minimum dry weight was recorded by HD-2189 (0.018 g), NIAW-3173 and NIAW-3166 (0.025 g). Genotype reported their inferiority at higher osmotic potential. Ahmadi *et al*. (2012). Reported that there was significant decrease in dry weight as per increase in osmotic potential in wheat. The present outcomes are in agreement with the results of Rauf *et al*. (2007), Moayedi *et al*. (2009), Ahamed *et al*. (2010), in wheat.

Seedling Vigour of wheat genotypes at 8th day
The mean seedling vigour for stress and non-stress conditions were recorded by daily count of seedlings emerged from day of planting the seeds. At non stress condition the genotypes NIAW-3056 (1718.56) and NIAW-3170 (1414.18) recorded maximum seedling vigour whereas, minimum seedling vigour was noted in NIAW-3173 (868.14) and NIAW-3056 (1045.78). At -0.1 MPa osmotic stress condition the genotype NIAW-1994 (1394.01) recorded maximum seedling vigour followed by HD-2189 (1106.00) and minimum values were recorded in NIAW-3183 (649.16) and NIAW-3161 (722.48).
In present study water stress significantly reduced the speed of germination and ultimately effects on seedling vigour. Baloch *et al*. (2012)[]. Reported that the better seedling vigour under water stress conditions is an important parameter for screening wheat genotypes for drought resistance. Similar results were also reported by Almansouri *et al*. (2001), Dhanda *et al*. (2004).

Germination stress index (GSI) (%) of wheat genotypes at 8th day.
The recorded data showed statistically non-significantly results at -0.1 and -1.3 MPa and significant at -0.5 and -0.7

MPa osmotic stress. At-0.5 MPa osmotic stress condition maximum GSI was recorded in genotype NIAW-3170 (83.19%) followed by NIAW-3183 (74.57%) and minimum GSI was recorded in the genotypes NIAW-3217 (49.11%) and NIAW-3056 (56.70%). It indicated that increased levels of osmotic stress decreased the GSI significantly. At -0.7 MPa osmotic stress condition, the genotypes NIAW-3170 (73.44%) and NIAW-1994 (55.88%) noted the highest GSI and lowest GSI were reported in the NIAW-3183 (4.08%) and NIAW-3161 (4.77%).

Seed germination is the most sensitive stage in the plant life cycle (Ashraf and Mehmood, 1990), and unfavourable environmental conditions e.g., water stress could have negative impact on the seed germination (Albuquerque and Carvalho, 2003). Also reported the drought stress to severely reduce sunflower seed germination and seedling establishment. Similar results were also reported by Jatoi *et al*. (2014).

Table 1: Thise table show that at 8th day germination, Shoot Length (cm) and Root Length (cm)

Sr. No.	Genotypes	% Germination at 8thday					Shoot Length (cm) at 8th day.					Root Length (cm) at 8th day.				
		0 Mpa Control	-0.1 Mpa	-0.3 Mpa	-0.5 Mpa	-0.7 Mpa	0 Mpa Control	-0.1 Mpa	-0.3 Mpa	-0.5 Mpa	-0.7 Mpa	0 Mpa Control	-0.1 Mpa	-0.3 Mpa	-0.5 Mpa	-0.7 Mpa
1	NIAW-3056	96.53	92.15	86.91	63.44	22.66	7.11	4.29	1.93	1.06	20.18	5.50	4.28	3.11	2.01	1.65
2	NIAW-3170	94.85	99.96	98.00	92.97	84.80	8.23	3.97	2.83	1.78	67.97	6.96	6.25	5.03	3.96	3.89
3	NIAW-3212	95.31	93.75	93.22	63.08	4.70	7.32	3.62	1.34	0.83	3.13	6.20	6.29	3.32	3.43	1.79
4	NIAW-3217	100.00	96.12	92.66	64.94	31.69	9.07	4.61	2.79	1.49	22.66	6.37	3.67	3.36	3.08	2.17
5	NIAW-3220	97.55	95.99	92.77	80.04	40.01	8.94	3.01	2.39	2.14	30.17	4.61	4.34	4.22	3.49	1.64
6	NIAW-3033	97.45	93.82	90.01	62.84	7.15	9.30	3.44	2.63	1.85	5.17	4.34	2.83	4.19	2.45	1.39
7	NIAW-3161	98.30	98.12	94.53	90.79	5.19	10.34	3.22	1.76	1.23	3.41	4.14	3.58	3.94	2.51	1.20
8	NIAW-3173	100.00	92.80	93.75	70.78	4.48	6.91	2.85	1.63	1.29	3.70	5.40	2.17	3.59	2.65	1.99
9	NIAW-3166	98.26	97.57	76.06	71.38	55.79	9.66	2.54	1.74	1.49	47.30	5.37	2.70	1.40	2.16	2.00
10	NIAW-3183	100.00	99.20	100.0	93.07	5.28	8.45	2.24	1.99	1.35	3.15	4.31	3.32	3.98	3.48	2.09
11	NI-5439	98.88	96.52	91.76	82.18	76.91	11.08	3.86	2.21	2.12	55.79	5.36	3.91	4.49	3.97	3.60
12	HD-2189	96.91	90.51	92.61	76.06	5.30	9.43	3.63	2.25	1.66	3.53	8.59	3.30	3.83	3.63	1.20
13	NIAW-1415	95.51	95.20	92.37	87.64	80.24	9.35	4.17	2.39	1.53	51.66	5.64	8.86	4.39	2.65	2.58
14	NIAW-1994	97.44	95.59	93.14	92.47	82.56	7.83	6.37	1.61	1.30	54.87	8.21	3.98	3.78	3.20	3.02
Mean		40.41	97.76	95.52	92.01	77.98	8.79	3.70	2.11	1.51	0.67	5.78	4.25	3.76	3.05	2.16
Source		Treatments (T)		Genotypes (G)		T X G	Treatments (T)		Genotypes (G)		T X G	Treatments (T)		Genotypes (G)		T X G
S.Em ±		0.21	0.09	0.77	0.21	0.09	0.012		0.005		0.045	0.015		0.006		0.056
CD at 5%		0.76	0.34	2.86	0.76	0.34	0.044		0.019		0.165	0.056		0.025		0.208

Table 2: Thise table show that at 8thday dry weight (g), seedling vigour and germination Stress index

Sr. No.	Genotypes	Dry weight (g) at 8th day.					Seedling Vigour at 8th day.					Germination Stress index (%) at 8th day.			
		0 Mpa Control	-0.1 Mpa	-0.3 Mpa	-0.5 Mpa	-0.7 Mpa	0 Mpa Control	-0.1 Mpa	-0.3 Mpa	-0.5 Mpa	-0.7 Mpa	-0.1 Mpa	-0.3 Mpa	-0.5 Mpa	-0.7 Mpa
1	NIAW-3056	0.027	0.024	0.021	0.014	0.013	1045.78	902.10	438.54	194.49	47.16	88.66	72.82	56.70	88.66
2	NIAW-3170	0.027	0.025	0.025	0.023	0.023	1414.18	1093.16	770.65	502.62	436.14	102.96	90.55	83.19	102.96
3	NIAW-3212	0.026	0.014	0.010	0.009	0.003	1280.00	920.21	433.69	268.98	10.91	94.79	83.73	61.10	94.79
4	NIAW-3217	0.026	0.024	0.020	0.015	0.011	1231.16	1055.54	569.91	297.27	87.75	91.10	76.53	49.11	91.10
5	NIAW-3220	0.027	0.028	0.026	0.024	0.020	1266.94	730.80	613.41	450.55	83.75	93.91	85.90	73.61	93.91
6	NIAW-3033	0.031	0.028	0.027	0.022	0.013	1137.59	730.19	613.81	270.41	11.64	102.82	80.53	57.01	102.82
7	NIAW-3161	0.027	0.018	0.017	0.014	0.009	1349.54	722.48	539.21	339.39	7.97	96.01	85.50	71.56	96.01
8	NIAW-3173	0.025	0.020	0.018	0.011	0.007	868.14	765.69	331.20	279.32	11.70	90.92	76.56	63.85	90.92
9	NIAW-3166	0.025	0.023	0.022	0.018	0.010	1121.00	772.07	238.58	260.84	178.88	92.05	77.24	63.76	92.05
10	NIAW-3183	0.026	0.025	0.020	0.013	0.005	1175.76	649.16	599.88	449.65	13.30	97.39	84.33	74.57	97.39
11	NI-5439	0.026	0.024	0.023	0.014	0.007	1434.34	1080.84	614.48	417.53	345.51	94.37	76.32	59.01	94.37
12	HD-2189	0.018	0.016	0.014	0.010	0.004	1188.90	1106.00	563.39	427.82	9.07	87.10	87.47	67.40	87.10
13	NIAW-1415	0.027	0.025	0.023	0.023	0.012	1718.56	933.31	626.47	366.63	276.26	85.99	74.74	67.59	85.99
14	NIAW-1994	0.031	0.027	0.025	0.018	0.012	1127.29	1394.01	502.30	416.10	328.56	91.00	77.79	68.63	91.00
Mean		0.026	0.023	0.021	0.016	0.011	1239.94	904.60	543.75	358.43	132.04	93.50	80.72	65.51	27.87
Source		Treatments (T)		Genotypes (G)		T X G	Treatments (T)		Genotypes (G)		T X G	Treatments (T)		Genotypes (G)	T X G
S.Em ±		0.0001		0.0000		0.0002	4.55		1.97		17.03	0.19		0.10	0.72
CD at 5%		0.0002		0.0001		0.0008	16.81		7.44		62.91	0.72		0.40	2.68

Conclusions

The following inferences were drawn from the investigations.

1. Seed germination test with different concentration of PEG showed significant differences between tolerant and susceptible genotypes. Hence it may be useful to screen large number of genotypes at early stage crop growth.
2. Ample phenotypic dissimilarity existed in the screened wheat genotypes for moisture stress tolerance.
3. Various osmotic stress levels had substantial effects on germination and early vegetative growth traits of wheat genotypes.
4. At -0.1 MPa osmotic stress condition genotypes NIAW-3170 and NI-5439 showed positive results for shoot length, root length.
5. Germination stress index decreases with increase in osmotic stress.
6. At an early stage of crop growth NIAW-3170, NI-5439 and NIAW-1994 may be considered as superior genotypes for moisture (drought) stress conditions.
7. The NIAW-3170, NI-5439 and NIAW-1994 were found best moisture stress tolerant genotypes, hence might be used as novel sources of drought tolerance. The HD-2189, NIAW-3173, NIAW-3166 and NIAW-3217 noted as moisture stress susceptible genotypes at early stage of crop growth.

References

1. Ahamed KU, Kamrun Nahar, Masayuki Fujita. Sowing date mediated heat stress affects the leaf growth and dry matter partitioning in some spring wheat (*Triticum aestivum* L.) cultivars. The IIOAB J. 2010; 1(3):8-16.

2. Ahmadi G, Akbarabadi A, Kahrizi D, Rezaizad A, Gheytouli M. Study of drought tolerance of bread wheat (*Triticum aestivum* L.) genotypes in seedling stage. Biharean Biologist. 2012; 6(2):77-80.
3. Albuquerque FMC, Carvalho NM de. Effect of type of environmental stress on the emergence of sunflower (*Helianthus annuus* L.), soyabean (*Glycine max* L. Merril) and maize (*Zea mays* L.) seeds with different levels of vigor. Seed Sci. Technol. 2003; 31:465-467.
4. Almansouri M, Kinet JM, Lutts S. Effect of salt and osmotic stresses on germination in durum wheat (*Triticum durum* Desf.). Plant Soil. 2001; 231:243-254.
5. Ashraf M, Mehmood S. Response of four Brassica species to drought stress, Environ. Expt. Bot. 1990; 30:93-100.
6. Badiane FA, Diouf D, Sane D, Diouf O, Goudiaby V, Diallo N. Screening cowpea (*Vigna unguiculata* L. Walp.) varieties by inducing water deficit and RAPD analyses. African J. Biote. 2004; 3:174-178.
7. Baloch MJ, Dunwell J, Khakwani AA, Dennet M, Jatoi WA, Channa SA. Assessment of wheat cultivars for drought tolerance via osmotic stress imposed at early seedling growth stages. J. Agric. Res. 2012; 50(3):299-310.
8. Dhanda SS, Sethi GS, Behl RK. Indices of drought tolerance in wheat genotypes at early stages of plant growth. J. Agron. Crop Sci. 2004; 190:6-12.
9. Fraser T, Silk W, Rosr T. Effect of low water potential on cortical cell length in growing region on maize roots. Pl. Physiol. 1990; 93:648-651.
10. Gao YP, Young L, Bonham-smith P, Gusta LV. Characterization and expression of plasma and tonoplast membrane aquaporins in primed seed of Brassica napus during germination under stress conditions. Plant Mol. Biol. 1999; 40:635-444.
11. Jatoi SA, Latif MM, Arif M, Ahson M, Khan A, Siddiqui SU. Comparative assessment of wheat landraces against polyethylene glycol simulated drought stress. Sci. Tech. and Dev. 2014; 33(1):1-6.
12. Moayedi AA, Boyceand AN, Barakbah SS. Study on osmotic stress tolerance in promising durum wheat genotypes using drought stress indices. Res. J. Agri. and Bio. Sci. 2009; 5(5):603-607.
13. Rauf M, Munir M, Hassan M, Ahmad M, Afzal M. Performance of wheat genotypes under osmotic stress at germination and early seedling growth stage. African J. Biotech. 2007; 6(80):971-975