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Effect of growth regulating substances on stratification of wild apricots (*Prunus armeniaca*) kernels under Kashmir conditions

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Rootstocks with desirable properties are pre-requisite for optimization of yield and quality. Report and references of rootstock effect on fruit yield, fruit quality, and resistance/ tolerance against various biotic and abiotic factors are in plenty. Wild apricot (*Prunus armeniaca* L.) seeds and seeds of commercial cultivars are commonly used for propagating apricot. Seeds of wild apricot and other stone fruits are dormant when they are harvested and require 2-3 month stratification (Martinez and Dicenta 2001) for germination and also for normal seedling growth. But due to hard seed coat and poor germination, wild apricot fails to establish satisfactory pure stands under natural conditions. Moreover, dormant seeds contain high amount of growth inhibitors and during cold stratification, its concentration and nature are altered (Davies and Duray 2006). Further, these alterations during stratification have been correlated with the release of seed from the dormant conditions. Earlier studies revealed the changes in the levels of growth inhibitors during stratification at low temperature (Chen *et al*. 2008), but very little and scanty information is available with the kernels of wild apricot. The present study was therefore, initiated to overcome the problem of hard seed coat for better germination and ensure commercial nursery production under Kashmir valley conditions.

The studies were carried out at experimental nursery site of Krishi Vigyan Kendra, Malangpora, district Pulwama, Jammu and Kashmir in 2007-08 and 2008-09. Fresh kernels extracted from the seeds of wild apricot collected from healthy and mature fruits were subjected to eleven different growth regulating substances as GA_3 (250, 500 and 750 ppm), Thiourea (0.2, 0.4 and 0.6%), KNO_3 (0.2, 0.3 and 0.4%) and seed as well as kernel as control. The trial was laid out in a factorial experiment in randomized block design with 2 stratification treatments. The treatments were replicated thrice and 100 seeds were sown under each replication. The data were recorded from randomly selected 20 seedlings under each replication and values were averaged. In first phase, kernels were soaked in the growth regulators for 24 hr and were put in the pits for stratification according to standard method. After two months, per cent germination was counted and then sown in the nursery. In the second phase, the kernels were soaked in the growth regulators for 24 hr and directly sown in the nursery beds and per cent germination was recorded after one month. After one month of sowing, survival rate for both stratified and un-stratified treatments was recorded. The data on seedling height (cm), collar diameter (mm), leaf area (cm^2), number of shoots and primary roots, fresh and dry weight of shoots and roots (g), shoot/root ratio, total dry weight (g) of seedlings were recorded at the end of the season. Sturdiness Quotient was calculated by seedling height/collar diameter. The data thus obtained for 2007-08 and 2008-09 was pooled and subjected to statistical analysis according to Gomez and Gomez (1984).

The performance of all characteristics measured except survival rate, shoot/root ratio and sturdiness quotient was recorded maximum under un-stratified kernels treatment compared to stratified kernels. Un-stratified seeds recorded maximum (72.24%) germination compared to stratified seeds (70.11%), whereas, per cent survival rate was recorded maximum (80.14%) under stratified seeds compared to un-stratified seeds (74.53%). Among the treatments applied, maximum (94.33%) germination was observed in 500 ppm GA_3 for un-stratified seeds, while, minimum (45.44%) was recorded in the kernels extracted from stones which were sown directly in the nursery (T_{11}) (Table 1). Similar trends for maximum germination (88.75%) were recorded for stratified seeds in 500 ppm GA_3, but minimum (52.05%) was recorded in 0.6% thiourea (T_6). After removal of endocarp from seeds and soaking for 24 hr in 1250 ppm GA_3 Ghayyad *et al*. (2010) also observed 70% of germination in *Prunus mahaleb*. Schronk (2010) observed maximum germination in kernels of peach after soaking them in GA_3 @ 3000 ppm. Ercisli and Guleryuz (1995) reported maximum germination

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Table 1 Germination, survival and growth performance of stratified and un-stratified kernel of wild apricot treated with different growth regulators (pooled data of two years)

Treatments	Treatment detail	1	2	3	4	5	6	7	8	9	10	11	12	13	14
							Stratified								
T_1	250 ppm GA_3	84.44	91.69	154.36	10.02	17.13	13.23	10.77	164.33	86.48	75.29	44.18	130.66	1.23	15.40
T_2	500 ppm GA_3	88.75	93.53	159.90	10.13	18.27	13.57	11.33	172.77	92.16	80.22	48.85	141.02	1.20	15.78
T_3	750 ppm GA_3	81.60	88.66	139.04	9.37	16.27	12.67	9.67	156.91	81.61	69.44	41.78	123.39	1.31	14.85
T_4	0.2% thiourea	67.04	80.06	92.43	7.56	9.10	10.30	7.83	121.81	64.74	52.62	26.53	91.26	1.32	12.24
T_5	0.4% thiourea	61.50	71.49	99.55	7.13	8.20	9.20	8.17	107.22	60.52	50.24	24.19	84.71	1.13	13.94
T_6	0.6% thiourea	52.05	69.35	80.05	7.31	8.67	10.07	7.67	98.20	55.46	47.68	24.91	80.37	1.31	10.97
T_7	0.2% KNO_3	77.64	90.42	135.17	8.84	14.23	12.76	10.17	141.07	75.97	66.11	38.46	114.43	1.25	15.28
T_8	0.3% KNO_3	72.24	84.03	139.57	8.54	12.23	12.56	10.90	136.57	72.26	62.79	35.72	107.98	1.15	16.33
T_9	0.4% KNO_3	67.44	80.11	119.44	8.28	10.13	11.30	10.53	125.34	69.00	57.16	31.53	100.53	1.07	14.40
T_{10}	Control (seed)	64.10	70.62	87.88	6.99	8.07	9.07	8.70	101.74	55.95	52.21	29.35	85.31	1.04	12.03
T_{11}	Control (kernel)	54.50	61.45	84.00	6.01	7.70	8.13	8.09	71.63	42.92	42.00	23.41	66.33	1.00	14.61
	Mean	70.11	80.14	117.39	8.19	11.81	11.17	9.44	127.05	68.83	59.61	33.54	102.36	1.18	14.16
	CD (*P=0.05*)	5.80	6.08	12.29	0.24	1.65	1.74	1.07	7.30	6.49	5.40	6.73	7.29	0.17	1.39
							Un-stratified								
T_1	250 ppm GA_3	91.36	88.44	166.20	11.54	24.07	17.26	12.67	192.35	93.79	91.53	59.48	153.28	1.38	14.41
T_2	500 ppm GA_3	94.33	90.75	172.40	11.13	23.87	23.17	14.47	199.65	110.14	83.11	57.37	167.52	1.61	15.50
T_3	750 ppm GA_3	83.30	85.50	157.00	11.99	20.63	19.67	11.57	180.14	90.47	97.08	55.12	145.59	1.70	13.10
T_4	0.2% thiourea	60.40	54.50	101.07	8.83	13.20	10.93	9.43	124.17	65.93	58.52	30.10	96.03	1.16	11.44
T_5	0.4% thiourea	54.02	62.75	112.80	8.35	11.40	12.33	8.90	116.11	70.26	51.85	32.76	103.03	1.40	13.51
T_6	0.6% thiourea	58.99	69.26	94.13	8.61	10.20	10.37	7.17	101.47	60.02	48.13	26.19	86.21	1.48	10.93
T_7	0.2% KNO_3	77.60	80.76	149.73	10.70	21.47	16.63	12.17	172.07	101.29	84.63	45.95	147.24	1.38	13.99
T_8	0.3% KNO_3	82.75	88.66	140.50	10.02	19.10	18.13	13.93	162.04	81.60	73.40	42.42	124.02	1.30	14.02
T_9	0.4% KNO_3	80.30	74.50	154.07	9.17	22.07	17.06	12.97	118.32	111.24	70.05	46.11	157.35	1.33	16.82
T_{10}	Control (seed)	66.14	70.75	100.40	7.23	11.27	9.93	7.33	110.70	62.73	42.03	25.20	87.93	1.37	13.89
T_{11}	Control (kernel)	45.44	54.01	82.37	6.36	9.67	9.33	6.20	77.97	41.85	36.81	22.89	64.74	1.52	12.69
	Mean	72.24	74.53	130.06	9.45	16.99	14.98	10.61	147.73	80.85	67.01	40.33	121.18	1.42	13.68
	CD (*P=0.05*)	6.23	5.62	12.10	0.26	1.70	1.79	1.73	8.24	8.32	9.33	7.79	10.27	0.28	1.51

1. Germination (%)
2. Survival rate (%)
3. Seedlings' height (cm)
4. Collar diameter (mm)
5. Leaf area (cm^2)
6. Number of shoots
7. Number of primary roots
8. Fresh weight of shoots (g)
9. Dry weight of shoots (g)
10. Fresh weight of roots (g)
11. Dry weight of roots (g)
12. Total dry weight of seedlings (g)
13. Shoot/root ratio
14. Sturdiness quotient

in the apricot seeds subjected to stratification for 63 days. Results obtained so far indicated that under Kashmir valley conditions where temperature goes below 7.2°C during winter, further stratification is not required. Similar trend was recorded for plant survival with maximum (93.53 and 90.75%) survival in T_2 and minimum (61.45 and 54.01%) in T_{11} under both stratified and un-stratified kernels, respectively. Among different growth substances, GA_3 showed better results followed by KNO_3 treatments. Survival rate of the seedlings was recorded low under un-stratified seeds as compared to stratified seeds.

Maximum seedling's height (130.06 cm) recorded in stratified seeds compared to un-stratified seeds (117.39 cm). Under stratification 500 ppm GA_3 recorded maximum (172.40 cm) seedlings' height which was statistically at par with T_1. Minimum seedlings' height (82.37 cm) was recorded in control (kernel) (Table 1). Diao *et al*. (2008) and Bhan and Sharma (2011) also reported that stratification followed by gibberellic acid treatment improved germination and increased plant height in wild apricot. Maximum collar diameter of 9.45 mm was registered in stratified kernels, however, minimum (8.19 mm) in kernels directly sown after treatment. Under stratification among all the treatments T_3 recorded maximum (11.99 mm) collar diameter, whereas minimum (6.36 mm) was recorded in control (kernel). The treatment T_2 recorded maximum (10.13 mm) and T_{11} minimum (6.01 mm) collar diameter under un-stratified kernels. Kernels subjected to stratification after growth regulators treatments recorded maximum (16.99 cm^2) leaf area compared to the kernels (11.17 cm^2) which were sown directly after treatment. T_1 registered maximum (24.07 cm^2) leaf area which was statistically at par with T_2 in the first phase, however, minimum (9.67 cm^2) was recorded in T_{11}, i.e. control (kernel). Under second phase (un-stratification), maximum (18.27 cm^2) leaf area was registered for T_2 which was statistically at par with T_1. Stratified kernels also recorded maximum number of shoots (14.98) and number of primary roots (10.61) compared to un-stratified seeds. In the first phase, the treatment of T_2 recorded maximum number of shoots (23.17) and number of primary roots (14.47) which were statistically higher than rest of the treatments.

Maximum (11.33) number of primary roots was recorded in T_2 which was recorded higher than other treatments (Table 1). Maximum fresh and dry shoot weight and fresh and dry root weight was recorded under stratified kernels compared to un-stratified kernel. Maximum fresh weight (199.65 g) of shoots was recorded in T_2 which was statistically at par with T_1. The treatment T_9 registered maximum (111.24 g) dry weight of shoots which was statistically at par with T_2 (110.14 g), however, minimum (41.85 g) was recorded under control (kernel). Under the second phase (when the kernels were sown directly after treatment), T_2 registered maximum fresh weight (172.77 g) and dry weight of shoots (93.16 g) which was statistically higher among all the treatments (Table 1). In the first phase, the treatment T_2 registered maximum (167.52 g) total dry weight of the seedlings which was statistically at par with T_9, and minimum (64.74 g) was registered under control (kernel), i.e. T_{11}. When the kernels were sown directly after treatment, T_2 recorded the highest (142.01 g) dry weight which was statistically higher among all the treatments applied, however, T_{11} registered with minimum (66.33 g) value (Table 1). Maximum shoot/root ratio (1.42) was noticed when the kernels were stratified after treatment and minimum (1.18) was recorded for un-stratified kernels. Samman *et al*. (2000) while treating the seeds of apricot with gibberellic acid observed the similar results with respect to most of the seedling growth characters as studied in the present study. Sturdiness quotient was recorded maximum (14.16) in stratified compared to the un-stratified phase. When the treated kernels were subjected to stratification, maximum (16.33) sturdiness quotient was calculated in T_8 which was statistically at par with T_2 (15.78), T_1 (15.40) and T_7 (15.28), whereas, minimum value for sturdiness quotient was calculated for T_{10}, i.e. control (stone). However, when the treated kernels were sown directly, T_9 scored maximum (16.82) sturdiness quotient which was statistically at par with T_2 (15.50). Overall, it is clear from the past (Samaan *et al.* 2000, Bhan and Sharma 2011) and from the present study that gibberellic acid is best for seed germination and seedling growth of wild apricot.

SUMMARY

An experiment carried out during 2007-08 and 2008-09 to investigate the effect of growth regulators on the stratified and un-stratified kernels of wild apricot (*Prunus armeniaca* L.). Three growth regulators at three different concentrations, viz. GA_3 @ 250, 500, 750 ppm, thiourea @ 0.2, 0.4, 0.6% and KNO_3 @ 0.2, 0.3 and 0.4 per cent were applied to the extracted kernels. Application of GA_3 @ 500 ppm proved best for the germination and growth of the seedlings of wild apricot. Further, it is also inferred from the study that there is no further need of artificially stratification of the wild apricot seeds in the Kashmir valley agro-climatic conditions.

REFERENCES

Bhan S and Sharma N C. 2011. Effect of seed stratification and chemical treatments on seed germination and subsequent seedling growth of wild apricot (*Prunus armeniaca* L.). *Research Journal of Agricultural Sciences* **2(1)**: 13–6

Chen S Y, Ching T C and Shing R K. 2008. Roles of gibberellins and abscisic acid in dormancy and germination of seeds of stone fruits. *Tree Physiology* **28**: 1 431–39.

Davies F T and Sharon A D. 2006. Study on seed germination and stress resistance of wild apricot (*Armeniaca vulgaris* Lam.) *Agriculture Science* **12**: 36–40

Diao Y Q, Liao K, Xu Z, Wang Q, Yang L, Geng W and Chen Y. 2008. Primary report on effect of related factor on germination of wild apricot seed. *HortScience* **33**: 119–23

Ercisli S and Guleryuz M. 1995. The relationship between

stratification periods and some characteristics of rootstock in apricot cultivars. *Acta Horticulturae* **384**: 477–82.

Ghayyad M, Kurbysa M and Napolsy G. 2010 Effect of endocarp removal, gibberellin, stratification and sulfuric acid on germination of Mahaleb (*Prunus mahaleb* L.) seeds. *American Eurasian Journal of Agriculture & Environment Science* **9(2)**: 163–16

Gomez K A and Gomez A A. 1984. *Statistical Procedures for Agricultural Research* 2nd ed., 680p. John Wiley & Sons, New York.

Martinez G P and Dicenta F. 2001. Mechanisms of dormancy in seeds of peach (*Prunus persica* (L.) Batsch) cv. GF 305. *Scientia horticulturae* **91**: 51–8.

Samaan L G, El-Baz E E T, Iraqi M A and El Dengawy E F A. 2000. Effect of gibberellic acid treatments on seed dormancy, germination and subsequent seedling growth of apricot (*Purnus armeniaca* L.) *Egyptian Journal of Horticulture* **27(2)**: 141–56

Schronk M J. 2010. Dormancy requirements for peach seeds under a greenhouse environment. *Egyptian Journal of Horticulture* **27**: 187–200