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Standardization of season of softwood grafting on survival and growth in hibiscus (*Hibiscus rosa-sinensis* L.) under konkon conditions of Maharashtra

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Abstract
An investigation entitled, "Standardization of season of softwood grafting on survival and growth in hibiscus (*Hibiscus rosa-sinensis* L.) under konkon conditions of Maharashtra'' was conducted to study the survival and growth performance of hibiscus grafts. Propagation through softwood grafting of Hibiscus, the grafts were tied in different season such as T_1: January, T_2: February, T_3: March, T_4: April, T_5: May, T_6: June, T_7: July, T_8: August, T_9: September, T_{10}: October, T_{11}: November, T_{12}: December and the experiment was conducted in randomized block design with twelve treatments and three replications. The maximum survival (96.67) and sprouting percentage (100.00), number of leaves (12.20) and sprouts (3.93) was recorded in the treatments T_4 (February). It can be concluded that propagation through softwood grafting in the treatment T_4 i.e. April month had proved to be the best month for propagation under konkon conditions of Maharashtra.

Keywords: Hibiscus, season, softwood grafting

Introduction
Hibiscus (*Hibiscus rosa-sinensis* L.) is a very important ornamental flowering shrubs growing wide range of climate all over the world. Hibiscus belongs to Malvaceae family. It is native from tropical Asia (Vietnam and Southern China). The flower are in many colours including red, pink, white, orange, yellow, purple and even multi-colour. The common name of Hibiscus is China rose, Chinese hibiscus, Gurhal, shoe flower and Jaswand. This plant is used for loose flower production for offering to the God, garden decoration in the shrubbery border and potted plant for home gardening, Sometimes its demand time to time increase during different Puja festivals.

It is propagated by sexual and asexual method of propagation. Sexually propagated plants come into bearing very late as compared to vegetative propagated. Grafting is a common method for propagating woody plants such as hibiscus. One reason for grafting a hibiscus is to use the root system of a strong variety to help support the growth of a less hardy variety. It is also a much faster way to grow new plants than starting with seeds. Sometimes cleft grafting is also done in hybrid varieties (Ibrahim *et al.* 2010) [6]. Hence a selection of scion and rootstock are also important for grafting. Healthy growth of rootstock and correct grafting technique probably will help to attain higher rate of success.

The time of propagation by vegetative means is considered to be the most vital factor that determines the success and establishment of grafts. Systematic information in this regard is scanty, so that an investigation was undertaken to standardize season of softwood grafting in hibiscus under konkon conditions of Maharashtra.

Material and Methods
The experiment was conducted in polyhouse no.4 Hi-tech project, Department of Horticulture, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during January 2018 to December 2018. There were twelve treatments of seasons and each was replicated thrice. The treatments were T_1: January, T_2: February, T_3: March, T_4: April, T_5: May, T_6: June, T_7: July, T_8: August, T_9: September, T_{10}: October, T_{11}: November, T_{12}:

December. Rootstock was local type and scion was *Hibiscus rosa-sinensis* L. and grafting type was softwood grafting.

The healthy vigorous seedlings having 25 to 30 cm height with 0.30 to 0.35 cm thickness at the collar region with 50 per cent green apical softwood were considered for grafting operation.

The softwood grafting operation was performed by the method described by Amin (1974) [1]. The top portion of the fresh growth developed on the stock plant was decapitated with knife keeping about 8.0 cm fresh stem. Then a top of seedlings was carefully split vertically in ´V´ shape up to 3 cm length. The cut portion looked like a fork or letter ´V´. The scion of about same thickness as that of stock was selected having a length of 10 cm. Therefore, the lower end of the scion was mended to 3 cm wedge by chopping off bark and little wood from two equal opposite sides. The wedge of scion was inserted in´ V´ shaped slit of stock and secured firmly with 1.5 cm wide and 45 cm long, 200 gauge thick white transparent polythene strip. The newly prepared grafts were then kept in shade and watered regularly at an interval of 2 to 4 days. Then shoots arising on rootstock were removed as and when appeared. Weeding and other operations were carried out at regular intervals. The prepared grafts were covered from top by polythene bags of 2.5 cm x 7.5 cm size as per treatment. The bag was retained on the graft for one month till sprouting was observed on the graft.

Result and Discussion

During the course of experiment various observations were recorded such as sprouting percentage (30 DAP), survival percentage (90 DAP), number of leaves, number of sprouts, diameter of sprout, plant height etc.

In Table 1. after one month, different treatments recorded significant difference in per cent sprouting. The highest per cent sprouting (100.00) was recorded in treatment T_4 (April). The lowest per cent sprouting (61.67) was noticed in the treatment T_1 (January).

After three months, different treatments showed significant difference in per cent survival. The highest per cent survival (96.67) was recorded in treatment T_4 (April). The lowest survival per cent (41.67) was noticed in treatment T_{12} (December). The higher grafting success depends on congenial environmental conditions prevailing during the period following grafting and rapid sap flow in stock and scion which might have favored the healing process and caused early callus formation and as a result established the continuity of cambium and vascular tissues for sprouting and ultimately higher plant survival (Chandel *et al.*, 1998).

In Table 2. after three months of grafting, the maximum number of leaves (12.20) was recorded in the treatment T_4 (April) which was at par with treatments T_9 (11.13), which was significantly superior over rest of treatments under study. The minimum number of leaves (8.13) was found in treatment T_8 (August).

Table 1: Sprouting and survival percentage of hibiscus grafts

Treatment details		Sprouting %	Survival %
		30 DAG	90 DAG
T_1	January	61.67 (51.76)	48.33 (44.04)
T_2	February	68.33 (55.77)	46.67 (43.08)
T_3	March	76.67 (61.14)	45.00 (42.12)
T_4	April	100.00 (90.00)	96.67 (83.86)
T_5	May	88.33 (70.11)	80.00 (63.55)
T_6	June	81.67 (65.00)	46.67 (43.09)
T_7	July	75.00 (60.07)	56.67 (48.85)
T_8	August	78.33 (62.40)	65.00 (53.76)
T_9	September	88.33 (70.11)	75.00 (60.07)
T_{10}	October	83.33 (65.95)	55.00 (47.88)
T_{11}	November	80.00 (63.55)	65.00 (53.76)
T_{12}	December	71.67 (57.86)	41.67 (40.20)
S.Em. ±		2.33	2.75
C.D. at 5%		6.82	8.06

Thus, maximum number of leaves might be due to cover on graft creates a microclimate for growth of the grafts which helps in fast cambium union activity which ultimately results in early sprouting and optimum maturity of scion with congenial environmental conditions promote the growth of the grafts, finally results in maximum number of leaves (Pampanna and Sulikeri, 1995) [8] in sapota.

After three months of grafting, the maximum number of sprouts (3.93) was recorded in the treatment T_4 (April) and which was at par with treatment T_9 (3.73), which was significantly superior over rest of treatments under study. The minimum number of sprouts (2.27) was found in treatment T_7 (July). Sprouting in grafting is considered as an indication of success in rooting. Average number of sprouts per graft was affected by season. April month resulted in better sprouting than other season due to the presence of sufficient growth promoting substances for both root and shoot initiation.

Table 2: Number of leaves, number of sprouts, diameter of sprout, height of hibiscus grafts

Treatment Details		No. of leaves	No. of sprouts	Diameter of sprout (mm)	Plant height (cm)
		90 DAG	90 DAG	90 DAG	90 DAG
T_1	January	8.87	2.80	1.87	46.51
T_2	February	9.07	2.60	1.86	48.33
T_3	March	9.60	3.00	1.84	48.10
T_4	April	12.20	3.93	2.08	52.59
T_5	May	10.67	2.47	2.14	52.08
T_6	June	9.07	2.53	2.05	51.21
T_7	July	8.93	2.27	1.91	51.28

T_8	August	8.13	2.80	1.87	47.97
T_9	September	11.13	3.73	2.03	52.09
T_{10}	October	10.40	3.33	1.78	50.13
T_{11}	November	9.67	3.27	1.74	49.87
T_{12}	December	8.40	2.40	1.77	48.56
S.Em. ±		0.38	0.10	0.03	0.34
C.D. at 5%		1.12	0.29	0.10	1.00

After three months of grafting, the higher diameter of sprout (2.14) was found in treatment T_5 (May) which was at par with the treatments T_4 (2.08) and T_6 (2.05) i.e. April and June, respectively. However, the lower diameter of sprout (1.74) was observed in treatment T_{11} (November). Thus, higher diameter of sprout might be due to stored carbohydrates and other food substances available in the scion sticks after defoliation of scion (Zimmerman, 1958).

After three months of grafting, all the treatments showed significant effect on plant height. The maximum plant height (52.59) was recorded in the treatment T_4 (April) which was at par with treatments T_9 (52.09) and T_5 (52.08). The minimum plant height (46.51) was found in treatment T_1 (January). Thus, more number of shoot and leaves triggered the process of photosynthesis which resulted in accumulation of energy. Simultaneously availability of moisture, nutrient through media resulted in more sprouting followed by increasing morphological characters like height, girth and number of leaves.

Conclusion

The above investigation helps to concluded that propagation through softwood grafting in Hibiscus (*Hibiscus rosa-sinensis* L.) under polyhouse conditions during the month of April had given promising results in growth parameters like per cent sprouting, per cent survival, number of leaves, number of sprout and plant height etc. Hence, from the present investigation carried out on the propagation of hibiscus through softwood grafting in the month of April had proved to be the best month for propagation under konkon conditions of Maharashtra.

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