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To study the effect of anti-transparent on propagation parameters of mulberry under polyhouse conditions with reduced water supply

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Abstract
The present investigation on "To Study The Effect of Anti-transparent on Propagation Parameters of Mulberry (*Morus spp*.) under Polyhouse Conditions With Reduced Water Supply" was carried out at college of temperate sericulture, Sher e Kashmir University of Agriculture Sciences and Technology of Kashmir during 2021 and 2022. During the study two Anti-transparent *viz*, Koalin and Salicyclic acid were used. During the study Kaolin has shown better results for survival percentage (88.33%), sprouting percentage (96.66%), sapling height (41.25 cm), sapling thickness (2.65 cm), chlorophyll a (1.60 mg/g), chlorophyll b (0.51 mg/g), total chlorophyll (2.06 mg/g), leaf moisture (71.45%), relative water content (84.27%) sapling height (41.25 cm), sapling thickness (2.65 cm) etc. under polyhouse conditions. While as salicyclic acid has resulted in increasing root weight (2.80 g) and root volume (2.98 cm^3).

Keywords: Anti-transparent, propagation parameters, reduced water

Introduction
Sericulture is an agro-based activity that involves mulberry (*Morus spp*) cultivation, silkworm rearing and the reeling of silk thread from the cocoons providing raw material for textile industry. The activity is mostly restricted to rural and suburban zones. It is an enterprise which provides employment to family members and requires low initial investment and least technicality. Mulberry which belongs to genus *Morus* of the family *Moraceae*, is the only food for silkworm (*Bombyx mori* L.). It is a hardy plant found globally in almost all types of agro climates extending from tropical to temperate regions. Mulberry is generally grown as trees in a scattered manner but the farmers often feel shortage of leaf during silkworm rearing, which in turn adversely affects the quality and productivity of produce and economics of sericulture as a whole (Mir *et al*., 2005) [4].
The plant is mostly propagated through grafting and cuttings besides seed sowing and layering. The success of these methods depends on a number of factors such as genetic makeup of the plant, age and physiological conditions of the parental cutting, climatic conditions and others. Using cuttings is probably the cheapest and easiest method for propagating new plants and this method is one of the possible techniques for vegetative propagation of trees along with timber species (Awang *et al*., 2009) [1]. Further the studies involving planting of mulberry cuttings under open field conditions have not yielded encouraging results giving even less than 10 percent success in Goshoerami which is the most popular and promising genotype in terms of leaf yield and quality (Baksh *et al*., 1998) [2]. Even the use of growth regulators involving additional expenditure on the cost of hormones, has not addressed the low survival of cuttings in the poor rooting but otherwise promising genotypes like Goshoerami, Ichinose and KNG.
The low-cost polyhouse technology developed by the College of Temperate Sericulture, Mirgund where survival of 60-70 percent in the otherwise shy to root mulberry genotypes is achieved at reduced time period of jusT_2 years as against 4-5 years through the conventional root grafting (Baqual *et al*., 2004) [2], holds a promise for multiplication of mulberry for sustainable sericulture practices.

Although the technique has helped to enhance the rooting percentage up to 70% as against 5-10% under open conditions, yet there is a further scope of increasing the survival percentage of saplings under ployhouse through different methods which include some measures like use of fungicides along with minimization of irrigation given to developing saplings through mist.

Keeping this in view, the present study entitled "Studies on the effect of anti-transparent on propagation of mulberry (*Morus spp.*), is aimed to work out the use of anti-transparent in mulberry propagation under polyhouse:-

Materials and Methods

The proposed investigation has been carried out at College of Temperate Sericulture, Mirgund. Nine months old mulberry shoots from Goshoerami variety of mulberry were used for preparation of cuttings. The cuttings of 13-15 cm length were prepared by giving slant cut without damaging the bark and splitting the wood. The cuttings prepared were dipped in 0.1 per cent Bavistin for half an hour to ensure the surface disinfection and render them free from any fungal contamination. The study was conducted under polyhouse during 2021 and 2022. The cuttings prepared were planted in poly bags of (4" × 11") containing the rooting medium compromising of sand, soil and FYM in the ratio of 6:3:1. These polybags with cuttings were placed in polyhouse by mid-march. The rooting media was kept moist by spraying water over it at frequent intervals two anti-transparent (Koalin and salicylic Acid) were used during the study along with different misting types.

Technical programme

Target Mulberry Genotype/Variety		**Goshoerami**
Experimental site		COTS Mirgund
Experimental Lab		College of Temperate Sericulture
No. of Anti-transparent used for study		02 A T_1: Kaolin @ 0.3% AT_2: Salicylic Acid @ 0.2%
No. of misting		05
Total No. of Treatment combinations		12
Treatment combination details		
Code	**Symbol**	**Detail**
T_1	A1M2	Misting once a day + AT_1
T_2	A2M2	Misting once a day + AT_2
T_3	A1M3	Misting twice a day + AT_1
T_4	A2M3	Misting twice a day + AT_2
T_5	A1M4	Misting once in 2 days + AT_1
T_6	A2M4	Misting once in 2 days + AT_2
T_7	A1M5	Misting once in 3 days + AT_1
T_8	A2M5	Misting once in 3 days + AT_2
T_9	A1M6	Misting twice in 3 days + AT_1
T_{10}	A2M6	Misting twice in 3 days + AT_2
T_{11}	A0M1	Misting thrice in a day (control)
T_{12}	A0M0	Absolute control

Results and discussion

Sprouting percentage (%): It was recorded at weekly intervals from the date of plantation of the cuttings and reached the highest (96.0%) in T_1 being at par with T_3 (95.5%), T_4 (95.0%), T_5 (95.67%) and T_{11} (94.00%) and statistically significant over rest of the treatments. It was, however, the least (87.33%) in T_{12}.

Survival (%)

The survival % age which remain persistent for about three weeks was recorded highest (87.67%) in T_3 which was statistically significant over rest of the treatments where it ranged from 10.50% in T_{12} to 83.67% in T_4.

No. of leaves/ sapling

It was the highest (13.66) in T_3 being significantly higher than the rest of the treatments where it ranged from 7 leaves per sapling each in T_7, T_8, T_{10} and T_{12} to 10.50 in T_4.

Leaf area (cm^2)

Initial leaf area recorded after one month of plantation of cuttings showed non-significant differences among the treatments. The values, however, ranged from 3.17 to 3.25 cm^2.

The final leaf area recorded showed significant differences among the treatments. it was the highest 60.17 cm^2 in T_3 being statistically significant over the rest of the treatments where it ranged from 42 Cm^{2}in T_{12} to 53.5 cm^2 in T_2.

Leaf area expansion (cm)

Leaf area expansion taken as the incremental increase in the leaf was highest (1762.84%) in T_3 which was significant over rest of the treatments**.** Leaf area expansion was least (1200.3%) in T-12. In the remaining treatments the values ranged from 1313.04 in T_7 and T_8 to 1618.75 percent in T-4.

Leaf moisture status of saplings

This was recorded in terms of moisture content, relative water content and water saturation deficit and the observations are furnished in Table 3 and described below in brief

Leaf moisture (%)

The results revealed that the highest leaf moisture content (71.45%) was recorded in T_3 which was statistically significant over the values recorded in other treatments. it was, however, the least (63%) in T_{12}.

Relative water content (%)

The highest relative water content (84.37%) was recorded in T_3, being at par with 82.37% in T_{11} and significantly higher than rest of the treatments. Relative water content was the least (69.27%) in T_8.

Water saturation deficit (%)
Lowest water saturation deficit (15.80%) was recorded in T_3 being statistically significant over rest of the treatments. On the other hand, water saturation deficit was highest (30.92%) in T_7.

Leaf chlorophyll content
The observations recorded for chlorophyll a, chlorophyll b and total chlorophyll are furnished in Table.4 and are described below in brief.

Chlorophyll a (mg/g)
As far as chlorophyll a in leaf is concerned, it was highest (1.60 mg/g) in T_3 being statistically significant over rest of the treatments where it ranged from 0.88 mg/g in T_{12} to 1.48 mg/g in T_4.

Chlorophyll b (mg/g)
It was the highest (0.51 mg/g) in T_3 being statististically significant over rest of the treatments. It was, however, the least (0.37 mg/g) in T_8. In the remaining genotypes it ranged from (0.38 mg/g) in T_{10} to 0.50 mg/g in T_2.

Total chlorophyll (mg/g)
The total chlorophyll followed the same trend and was again highest (2.06 mg/g) in T_3 which was statistically significant over rest of the treatments. The least total chlorophyll (1.25 mg/g) was recorded in T_8.

Sapling height (cm)
The highest sapling height (41.25 cm) was recorded in T_3 which was statistically significant over rest of the treatments. However, the least sapling height (0.35 cm) was recorded in T_7.

Sapling thickness (cm)
The highest sapling thickness (2.65 cm) was recorded in T_3 being statistically significant over rest of the treatments. It was, however the least (1.58 cm) in T_{12}.

Shoot biomass (g)
The highest shoot biomass (11.28 g) was recorded in T_3. This was statistically significant over rest of the treatments where it ranged from (6.20 g) in T_{12} to (10.08 g) in T_4. However, the least shoot biomass (6.20 g) was recorded in T_{12}.

Root biomass (g)
The highest root biomass (2.80 g) was recorded in T_4 being statistically significant over rest of the treatments. The least root biomass (1.05 g) was recorded in T_{12}.

Root shoot ratio
The root shoot ratio in terms of root proportion by weight was maximum (0.24) in T_3 being at par with 0.22 in T_4 and T_{11}. The root proportion in other treatments ranged from 0.17 in T_{12}, T_{10}, T_9, T_8 and T_7 To 0.20 in T_1.

Number of roots per sapling
The no. of roots per sapling were highest (22.50) in T_3. This was statistically significant over the rest of the treatments were the no. of roots per sapling ranged from 13.0 in T_2 to 18.5 in T_4 and T_6. It was, however, least (12.00) in T_{12}.

Length of longest root (cm)
The results indicated that length of longest root was statistically significant over rest of the treatments being higher 16.88 cm in T_8. However, the least root length (10.12 cm) was observed in T_{12}.

Total root length (cm)
The total root length was highest (137.00 cm) in T_3 which was statistically significant over rest of the treatments. However, the total root length was least (67.50 cm) in T_{12}.

Root volume
The maximum root volume (2.98 cm^3) was observed in T_3 which was statistically significant over rest of the treatments. However, minimum root volume (0.95 cm^3) was recorded in T_{12}.

Table 1: Sprouting % age, survival % age, number of leaves, leaf area and leaf area expansion of cuttings as influenced by Anti-transparent under Poly house conditions

Treatment	Sprouting %	Survival %	Number of leaves	Leaf area (cm^2)	Leaf area Expansion		
					Initial leaf area (cm^2)	Final leaf area (cm^2)	Incremental increase (%)
T_1	96.00	82.50	9.500	53.000	3.20	53.000	1556.25
T_2	91.17	79.67	9.000	53.500	3.25	53.500	1546.15
T_3	95.50	87.67	13.667	60.167	3.23	60.167	1762.84
T_4	95.00	83.67	10.500	55.000	3.25	55.000	1618.75
T_5	95.67	77.67	8.500	50.500	3.20	50.500	1478.12
T_6	90.17	77.33	8.500	52.000	3.21	52.000	1519.93
T_7	87.67	59.50	7.000	45.500	3.22	45.500	1313.04
T_8	90.50	55.00	7.000	45.000	3.19	45.000	1310.65
T_9	89.00	67.67	8.000	48.667	3.25	48.667	1397.53
T_{10}	90.50	66.00	7.000	46.833	3.23	46.833	1349.84
T_{11}	94.00	77.00	9.000	49.000	3.17	49.000	1445.74
T_{12}	87.33	10.50	7.000	42.000	3.23	42.000	1200.3
CD ($p \leq 0.05$)	2.67	1.82	1.851	2.274	NS	2.274	50.41

Table 2: Effect of anti-transparent on leaf moisture, relative water content, water saturation, chlorophyll a, chlorophyll b, and Total chlorophyll under Poly house conditions.

Treatment	Leaf moisture (%)	Relative water content (%)	Water saturation deficit (%)	Chlorophyll a (mg/g)	Chlorophyll b (mg/g)	Total chlorophyll (mg/g)
T_1	68.57 (8.34)	78.10 (8.89)	22.17 (4.71)	1.45	0.48	1.92
T_2	68.05 (8.30)	74.90 (8.71)	23.50 (4.84)	1.41	0.50	1.91
T_3	71.45 (8.511)	84.37 (9.24)	15.80 (3.97)	1.60	0.51	2.06
T_4	69.12 (8.37)	80.68 (9.03)	17.47 (4.17)	1.48	0.49	1.96
T_5	66.53 (8.21)	76.10 (8.78)	25.08 (5.00)	1.36	0.47	1.83
T_6	66.48 (8.21)	75.10 (8.73)	25.35 (5.030	1.32	0.45	1.77
T_7	64.43 (8.08)	73.70 (11.36)	30.92 (5.56)	1.15	0.37	1.52
T_8	63.30 (8.018)	69.27 (8.37)	30.70 (5.54)	1.05	0.37	1.25
T_9	65.42 (8.14)	73.17 (8.61)	27.32 (5.226)	1.27	0.45	1.72
T_{10}	64.92 (8.118)	71.85 (8.54)	27.45 (5.23)	1.21	0.38	1.58
T_{11}	70.62 (8.46)	82.37 (9.13)	16.12 (4.01)	1.41	0.52	1.93
T_{12}	63.00 (7.99)	80.03 (9.00)	17.15 (4.14)	0.88	0.47	1.35
CD ($p\leq0.05$)	1.64	2.96	1.610	0.25	0.06	0.26

*values in parenthesis are square root transformed values

Table 3: Effect of anti-transparent on sapling height, sapling thickness, shoot biomass, root biomass, root shoot ratio, no. of roots and length of longest root of saplings under Poly house conditions

Treatment	Sapling height (cm)	Sapling thickness (cm)	Shoot biomas (g)	Root biomass (g)	Root shoot ratio	No. of roots per sapling	Length of longest root (cm)
T_1	36.28	2.30	10.00	1.95	0.20	18.50	13.90
T_2	35.02	2.27	9.75	2.15	0.2	17.50	12.88
T_3	41.25	2.65	11.28	2.33	0.24	22.50	13.60
T_4	37.73	2.37	10.08	2.80	0.22	18.50	13.15
T_5	34.57	2.25	9.55	1.75	0.19	16.50	14.42
T_6	33.70	2.02	9.28	1.87	0.18	18.50	13.95
T_7	30.97	2.00	7.65	1.30	0.17	13.50	15.20
T_8	30.35	1.85	7.45	1.30	0.17	13.00	16.89
T_9	32.58	2.25	8.75	1.45	0.17	16.00	14.97
T_{10}	32.32	2.05	8.45	1.55	0.17	15.00	14.45
T_{11}	34.33	1.83	9.12	2.02	0.22	16.50	12.55
T_{12}	33.22	1.58	6.20	1.05	0.17	12.00	10.12
CD ($p\leq0.05$)	1.07	0.22	0.29	0.25	0.03	2.027	0.377

Table 4: Effect of anti-transparent on sapling total root length and root volume of saplings under Poly house conditions.

Treatment	Total root length (cm)	Root volume cm^3
T_1	123.00	2.450
T_2	117.17	2.267
T_3	137.00	2.983
T_4	125.67	2.650
T_5	109.00	2.000
T_6	104.33	1.833
T_7	80.50	1.333
T_8	74.00	1.300
T_9	95.67	1.750
T_{10}	89.00	1.600
T_{11}	113.50	2.183
T_{12}	67.50	0.950
CD ($p\leq0.05$)	3.82	0.234

Discussion

The study has clearly indicated that out of the two anti-transparent used during the study (kaolin 0.3% + misting twice a day) has registered highest values in most of the parameters including survival percentage, no. of leaves, length of longest root, total root length, shoot weight, sapling height, sapling thickness, leaf area, leaf moisture, relative water content, water saturation deficit chlorophyll a, chlorophyll b and total chlorophyll under polyhouse conditions. Salicylic acid has also registered better survival of saplings under polyhouse as against its survival under open conditions, which might be attributed to availability of required ambient hygrothermic conditions in polyhouse which in turn might have contributed to growth parameters of saplings. T_3 (kaolin 0.3% + irrigation twice a day) has resulted in increased growth parameters of saplings including survival percentage, sapling height, sapling thickness, etc as compared to control which might be again be attributed to application of anti-transparent. The results of the study indicated that the use of anti-transparent can increase moisture content as compared to the control. However among the two anti-transparent used viz (kaolin 0.3%) (T_3) has resulted in increased moisture content as compared to the control. Chlorophyll plays an important role in plant growth, it is the green pigment located in the chloroplasts that are site for the process of photosynthesis. The function of chlorophyll is to capture the light energy of the sun and convert water and carbon dioxide to produce glucose and oxygen. The results revealed that the use of anti-transparent increased the chlorophyll content in mulberry leaves as compared to the control out of the two anti-transparent used during the study kaolin 0.3% has excelled better than salicylic acid. Relative leaf water content is an important indicator of water status in plants which indicates the balance between water supply to the leaf tissue and transpiration rate. It is the amount of water in a leaf at the time of sampling to the maximal water a leaf can hold up to prescheduled period. The relative water content was observed highest in treatments treated with anti-transparent as compared to control where no anti-transparent was sprayed. The results of the study also revealed that the application of anti-transparent reduces stomatal conductance and rate of transpiration as they form film on leaf surface which limit the stomatal conductance and transpiration. The results also revealed that the use of anti-transparent has increased the photosynthetic rate in most of the treatments as compared to the control.

Conclusion

Under polyhouse conditions treatment T_3 involving misting twice a day accompanied with the foliar application of anti-transparent (0.3% Kaolin) proved to be significantly better than the other treatments as far as various growth parameters- sapling height, sapling thickness, number of leaves and survival etc of mulberry saplings are concerned. It was also observed that application of salicylic acid resulted in improved root parameters of saplings including root weight and root volume as well.

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