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Influence of Sucrose Levels and LED Light Spectra on In Vitro Propagation of Cornelian cherry (*Cornus mas* 'Podolski')

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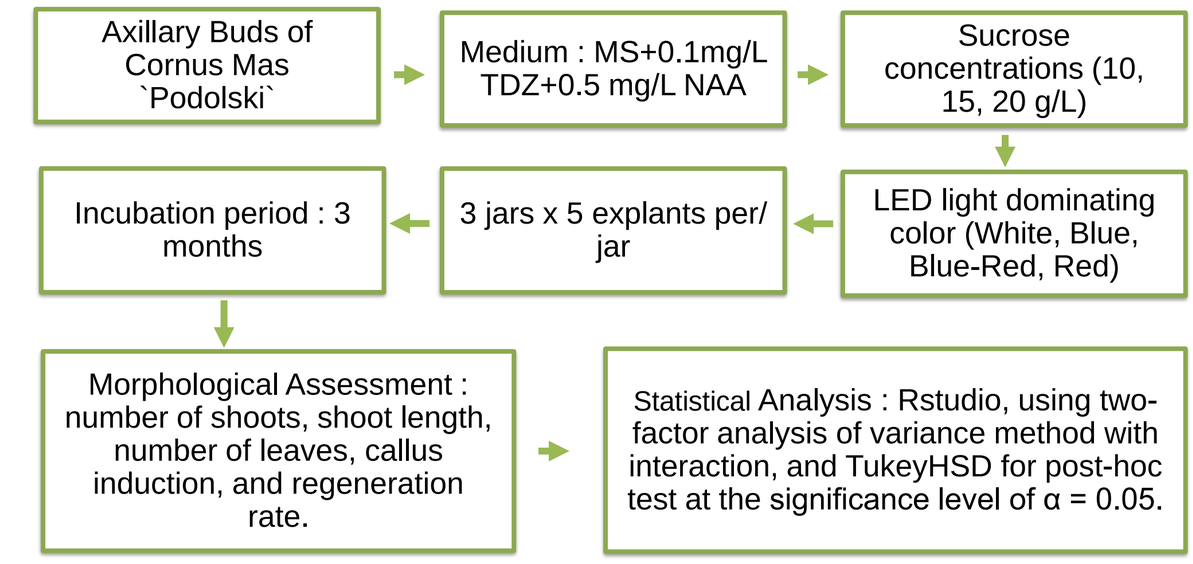
INTRODUCTION & AIM

Figure 1. *Cornus mas* `*Podolski*` plant by kielkowski-szkolka.pl

- Cornelian cherry or *Cornus mas* is well known for its nutritional, medicinal, and ornamental uses. The cultivar *Cornus mas* 'Podolski' is particularly valued for its larger fruit size, high yield, and adaptability, making it a promising candidate for commercial cultivation and landscape use [1].
- Conventional propagation methods are limited, necessitating the development of efficient *in vitro* techniques.
- Light-emitting diodes (LEDs) are currently being used as a light source for *in vitro* regeneration or the growth of plants in a controlled environment [2].
- The objective of the present work was to investigate the influence of varying sucrose concentrations (10 g·L^{-1}, 15 g·L^{-1}, 20 g·L^{-1}) and different dominating LED light spectra; White (Control); Blue (B); Blue-Red (BR); and Red (R) on the *in vitro* growth and morphogenesis of C. *mas* 'Podolski'.

METHOD



RESULTS & DISCUSSION

Table 1. The effect of LED light color and sucrose level (g.L-1) on the number of *in vitro* regenerating *Cornus mas* 'Podolski' shoots.

LED color/ Sucrose level	White (Control)	Blue	Blue-Red	Red	Means (Sucrose Level)
10	3.50 ± 0.30 ab	5.20 ± 0.40 bc	6.00 ± 0.50 c	5.90 ± 0.45 c	5.15 ± 0.45 bc
15	4.10 ± 0.35 b	5.50 ± 0.45 bc	4.80 ± 0.40 b	5.60 ± 0.50 bc	4.83 ± 0.40 b
20	3.00 ± 0.25 a	4.70 ± 0.35 b	5.40 ± 0.45 bc	5.00 ± 0.40 bc	4.53 ± 0.38 b
Means (LED color)	3.53 ± 0.30 a	5.13 ± 0.40 bc	5.40 ± 0.45 bc	5.50 ± 0.45 bc	

- The blue-red LED produced the highest number of shoots at 10 g.L^{-1} sucrose, but not at other sucrose levels.
- The red LED resulted in consistently high shoot numbers across all sucrose levels, whereas the white LED produced the lowest shoot numbers at 20 g.L^{-1} sucrose.

Table 2. The effect of LED light color and sucrose level (g.L-1) on the length of *in vitro* regenerating *Cornus mas* 'Podolski' shoots.

LED color/ Sucrose level	White (Control)	Blue	Blue-Red	Red	Means (Sucrose Level)
10	2.80 ± 0.25 ab	4.00 ± 0.30 bc	4.50 ± 0.40 c	3.90 ± 0.35 bc	3.80 ± 0.35 b
15	3.20 ± 0.30 b	4.10 ± 0.35 bc	3.70 ± 0.30 b	4.30 ± 0.40 bc	3.83 ± 0.34 b
20	2.40 ± 0.20 a	3.80 ± 0.30 b	4.20 ± 0.35 bc	4.00 ± 0.30 bc	3.60 ± 0.30 ab
Means (LED color)	2.80 ± 0.25 a	3.97 ± 0.32 b	4.13 ± 0.35 bc	4.07 ± 0.34 bc	

- The blue-red LED produced the highest shoot length at 10 g.L^{-1} sucrose (**4.50 ± 0.40**), while the blue LED produced the second highest shoot length (**4.10 ± 0.35**) at 15 g.L^{-1} sucrose.
- White LED consistently resulted in shorter shoots compared to colored LEDs, regardless of the sucrose level.

Table 3. The effect of LED light color and sucrose level (g.L-1) on the number of *in vitro Cornus mas* 'Podolski' leaves.

LED color/ Sucrose level	White (Control)	Blue	Blue-Red	Red	Means (Sucrose Level)
10	4.50 ± 0.40 b	6.20 ± 0.50 bc	6.50 ± 0.60 c	6.30 ± 0.55 c	5.88 ± 0.51 bc
15	5.00 ± 0.45 b	6.50 ± 0.55 bc	6.00 ± 0.50 bc	6.40 ± 0.60 c	5.98 ± 0.53 bc
20	3.80 ± 0.35 a	5.90 ± 0.50 bc	6.20 ± 0.55 bc	6.00 ± 0.50 bc	5.23 ± 0.48 b
Means (LED color)	4.43 ± 0.40 b	6.20 ± 0.52 bc	6.23 ± 0.55 bc	6.23 ± 0.55 bc	

The combination of Blue-Red light at a sucrose level of 10 g·L^{-1} produced the highest number of leaves (6.50 ± 0.60), while White light at a sucrose level of 20 g·L^{-1} produced the lowest number of leaves (3.80 ± 0.35).

Table 4. The effect of LED light color and sucrose level (g.L-1) on *in vitro Cornus mas* 'Podolski' regeneration percentage.

LED color/ Sucrose level	White (Control)	Blue	Blue-Red	Red	Means (Sucrose Level)
10	80.00 ± 5.00 b	90.00 ± 6.00 bc	95.00 ± 6.50 c	92.00 ± 6.20 bc	89.25 ± 5.93 bc
15	85.00 ± 5.50 bc	91.00 ± 6.20 bc	92.00 ± 6.20 bc	94.00 ± 6.30 bc	90.50 ± 6.05 bc
20	70.00 ± 4.50 a	85.00 ± 5.50 b	90.00 ± 6.00 bc	88.00 ± 5.90 bc	83.25 ± 5.48 ab
Means (LED color)	78.33 ± 5.00 ab	88.67 ± 5.90 bc	92.33 ± 6.23 bc	91.33 ± 6.13 bc	

The combination of Blue-Red light and a sucrose level of 10 g·L^{-1} produces the highest regeneration percentage, while White light at 20 g·L^{-1} results in the lowest regeneration percentage.

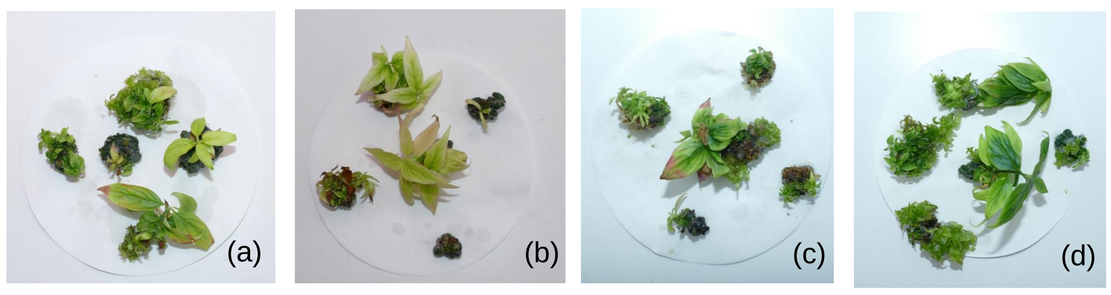


Figure 2. *In vitro Cornus mas* `*Podolski*` plant; (a) White LED; (b) Blue LED; (c) Blue-Red LED; (d) Red LED

CONCLUSION

The results showed significant interactions between sucrose concentration and light spectrum, influencing growth parameters like shoot number, shoot length, leaf count, and regeneration percentage. The White-Red combination generally yielded the best results, while the Red-Blue-Red combination showed the poorest outcomes. Higher sucrose concentrations (20 g·L^{-1}) tended to decrease growth performance in some cases.

REFERENCES

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2. Dutta Gupta, S., & Jatothu, B. (2013). Fundamentals and applications of light-emitting diodes (LEDs) in in vitro plant growth and morphogenesis. *Plant biotechnology reports*, *7*, 211-220.