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The Influence of Some Cytokinins on Shoot Development of *Syngonium podophyllum* cv. White Butterfly *in vitro*

Wpływ kilku cytokinin na rozwój pędów *Syngonium podophyllum* cv. White Butterfly *in vitro*

Syngonium podophyllum cv. White Butterfly is a popular foliage plant, which exhibits very attractive leaves. Young leaves are green with white veins. At maturity the leaf becomes about 80% white with a green border. *Syngonium* is generally propagated vegetatively by stem cuttings. Although this method is easy, the tissue culture procedure can improve substantially the rate multiplication of their plants. This study was initiated to investigate the regenerative capacity of different explants of *Syngonium podophyllum* cv. White Butterfly in order to devise the *in vitro* method of rapid propagation.

In literature there are a few papers on the subject of influence of growth regulators on *Syngonium* shoot development *in vitro* (Miller and Murashige, 1976; Makino and Makino, 1978; Michel, 1988).

MATERIAL AND METHODS

Shoot tips, axillary buds and nodal sections of stems from shoot clusters of *Syngonium podophyllum* cv. White Butterfly grown *in vitro*, were used as material in the experiment. Shoot clusters were achieved from shoot tips and axillary buds taken from mother plants grown in a greenhouse. Previously, mother plant parts were rinsed in running tap water for one hour, and then surface sterilized for 30 minutes in sodium hypochlorite containing 0.5% active chlorine and finaly washed twice in sterile water. Surface sterilized shoot tips and axillary buds were reduced into 2-3 mm in length and were cultured on the solid medium in the test tubes (25 x 100 mm).

The basic medium contained: Murashige and Skoog (1962) mineral salts, NaH_2PO_4 – 170 mg/l, thiamine - 0.4 mg/l, pyridoxine – 0.5 mg/l, nicotinic acid – 0.5 mg/l, and sucrose – 30 g/l. The pH was adjusted to 5.7. The explants from mother plants were multiplied on the basic medium supplemented with 5 mg/l of 2iP and 0.5 mg/l of IAA. After six months of the multiplication, shoot tips, axillary buds and nodal sections of stems were dissected from shoot clusters and were used as primary material for the experiment.

The influence of BA in the concentration of 22.2 μM, kinetin – 23.2 μM and 2iP – 24.5 μM on the growth and development of explants was investigated. Explants grown on the basic medium without growth regulators were used as the control.

Tissues were maintained in the growth chamber at 25°C, with 16-hour photoperiod and light intensity of 6.5 W/m^2. After 16 weeks (2 passages) the regenerative capacity of all explants was determined. The experiment was repeated twice with twenty five replications in each treatment. One replication consisted of a test tube with one explant. The results of the experiment were analysed statistically.

RESULTS

Small differences in the number of new shoots among the examined explants were found. Axillary buds showed the higher capacity for shoot formation. Shoot tips and nodes were less active.

Among the 3 cytokinins, 2iP was the most effective in causing shoot formation from shoot tips and axillary buds. Nodal parts of stem formed the most shoots on the medium supplemented by BA (table 1). The highest average number of shoots (4.3) was found from axillary buds on medium with 24.5 μM of 2iP. The shoots obtained on the media with 2iP had significantly higher fresh weight than shoots which were formed on the media containing BA or kinetin. The growth of shoots was the weakest on the media with BA. The cytokinins influenced the elongation of shoots.

Tab. 1. The influence of cytokinins on the growth and development of *Syngonium podophyllum* cv. White Butterfly explants

Explant	Cytokinin	Concetrat. μM	Number of axillary shoots per explant	Fresh weight of one axillary shoot (mg)	Length of axillary shoots (mm)	Fresh weight of basal tissue (mg)
Shoot tips	Control	0	1.2 c*	24.4 d	8.3 d	22.8 c
	BA	22.2	2.6 bc	49.8 c	14.6 cd	131.8 c
	Kinetin	23.2	2.1 bc	121.8 abc	25.9 abcd	98.8 c
	2iP	24.5	3.7 ab	182.5 a	41.4 ab	796.3 a
Axillary buds	Control	0	1.1 c	21.2 d	10.1 d	33.2 c
	BA	22.2	3.2 abc	65.6 c	23.8 bcd	816.5 a
	Kinetin	23.2	2.3 bc	94.4 bc	26.5 abcd	84.0 c
	2iP	24.5	4.3 a	154.7 ab	38.7 ab	739.0 a
Nodes	Control	0	1.4 c	15.9 d	9.4 d	16.9 c
	BA	22.2	3.6 ab	42.6 c	23.4 bcd	347.6 b
	Kinetin	23.2	1.8 c	99.6 bc	31.2 abc	42.4 c
	2iP	24.5	3.2 abc	169.5 ab	45.7 a	706.6 a

*Values followed by the same letter do not differ significantly.

The shoots grown on the media with 2iP achieved the greatest length. It was noticed that shoots obtained from nodal sections of stems grew rapidly and reached the highest length (45.7 mm).

The differences in the morphology of shoots obtained on the medium with different cytokinin were observed. On the medium containing 24.5 μM of 2iP the shoots were characterized with the highest fresh weight and the shoot elongation was the most intensive. At the presence of BA the shoots were the smallest and the leaf blades were slightly tinier.

It was found that all the tested explants developed a basal tissue from which the shoots and roots emerged. The greatest amount of this tissue was obtained from axillary buds cultured on the medium with BA at 24.5 μM. On the control medium fresh weight of basal tissue was the lowest.

DISCUSSION AND CONCLUSIONS

The experiments indicate that shoot tips, axillary buds or nodes can be used as initial explants for propagation of *Syngonium in vitro*. Also Miller and Murashige (1976), Makino and Makino (1978) and Michel (1988) used shoot tips and axillary buds for multiplication of *Syngonium podophyllum*. These kinds of explants are recommended in micropropagation of many other ornamental plants, such as: *Cordyline* (Kunisaki, 1975; Miller and Murashige, 1976), *Dracaena, Scindapsus* (Miller and Murashige, 1976), *Spathiphyllum* 'Clevelandii' (Fonnesbech and Fonnesbech, 1979).

Miller and Murashige (1976) noticed no difference in the behavior of *in vitro* shoot tips from terminal and lateral buds. There were found only small differences in the number, fresh weight and length of axillary shoots received from explants used in our study.

In our experiment, shoot induction was stimulated by the application of cytokinin. The explants grown on the medium containing 2iP or BA regenerated more axillary shoots than on the medium supplemented with kinetin. Also Miller and Murashige (1976) observed poor response of *Syngonium* to kinetin. The best results of shoot induction from primary explants were obtained on the medium with 2iP in the concentration of 24.5 μM. Miller and Murashige (1976) recommend 2iP in the concentration of 3 mg/l and IAA at 1 mg/l – for *Syngonium* starting medium and 2iP alone in the concentration of 20 mg/l – for *Syngonium* multiplication medium. Michel (1988) worked with *Syngonium podophyllum* cv. White Butterfly and found that MS medium with BA and IAA gave the best result for induction and multiplication of shoots.

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STRESZCZENIE

Badano wpływ trzech cytokinin (BA w stężeniu 22,5 μM, kinetyna – 23,2 μM i 2iP – 24,5 μM) na wzrost i rozwój wierzchołków wzrostu, pąków kątowych i węzłów *Syngonium podophyllum* cv. White Butterfly. Eksplantaty pobierano z aseptycznie rosnących roślin matecznych mnożonych *in vitro*. Zastosowano zmodyfikowaną pożywkę wg Murashige'a i Skoog (1962).

Spośród badanych cytokinin najsilniejszy wpływ na regenerację pędów wykazywała izopentenyloadenina (2iP). Największy współczynnik namnażania (4,3) uzyskano z pąków kątowych. Nie stwierdzono istotnych różnic w zdolności regeneracyjnej badanych eksplantatów.