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EFFECT OF EXTERNAL FACTORS ON GROWTH AND MORPHOGENESIS IN LEMNA TRISULCA L. IN AXENIC CULTURE. II. LIGHT CONDITIONS

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INTRODUCTION

Morphogenetic effects of light of narrow spectral regions have been the well–known phenomena in all higher plants. In the species belonging to the fam. *Lemnaceae,* the effect of light is mainly studied in relation to the photoperiodic reaction. The regulation of flowering by phytochrome is well established. Many studies were done by applying „end–of–day" or „night–break" red and far red irradiations. Much less is known about the effect of coloured light on vegetative growth. Z u r z y c k i (1957) has found that the light of different wavelengths had a conspicuous effect on the morphogenetic characters in *L. trisulca.* Since the *Lemnaceae* can be grown in axenic culture, with the supply of carbohydrates in the medium, the morphogenetic action of light can be studied almost independently of photosynthesis. The present paper describes some preliminary results on the effect of continuous red and blue light on the morphology of *L. trisulca* colonies.

MATERIAL AND METHODS

The cultivation of *Lemna trisulca* L. colonies was the same as described in the Part I of this paper (B a t a and N e š k o v i ć, 1982). The three–membered colony for inoculation was taken from the stock growing in white light. Erlenmayer flasks were kept in continuous coloured light, at 25 ± 1°C, in light–tight boxes. Red light (RL) was obtained from 8 red fluorescent tubes (Philips TL 15), equipped with red plexiglass filters (Rohm & Haas, No. 501). Light intensity was 11.2 μW cm^{-2} nm^{-1} at 660 nm, half band width 27 nm. The source of blue light (BL) were 8 blue fluorescent tubes (Philips TL 17), with a blue plexiglass filter (Rohm & Haas, No. 627). The intensity was 0.86 μW cm^{-2} nm^{-1} at 460 nm, half band width 20 nm. Light intensities were

measured using an ISCO spectroradiometer, model SR. All other conditions were as described previously.

RESULTS AND DISCUSSION

The cultures grown in red light were rather similar to those grown as a stock in white fluorescent light, which were the source of the inoculum. The size of fronds through 4 generations was in the range of the mother frond. They were branched and assymetric, with long thin roots. The only effect of red light was a somewhat increased length of petioles in the 3rd and 4th generations, in comparison to the older ones. After 42 days, the colonies usually desintegrated.

Contrary to this, the continuous BL had a striking effect on the morphology of the colonies. This concerns all aspects of their growth. The most conspicuous feature was the shortness of their petioles. While in the 1st generation the left and right petioles still reached the values between 4–6 mm, in the 2nd, 3rd and 4th generations the left petioles were not longer than 1.0–2.0 mm. The right ones were still shorter and were actually not measurable. This gave to the colonies the appearance of rosettes or cushions (Fig. 1). The size of fronds was also decreasing in younger generations; in the inoculum and in the 1st generation the length/width was 5.3./2.2, while in the younger fronds the values were between 3.6/2.0 and 4.3/2.5. As can be noticed, the length of fronds was affected, and not the width. Therefore, the shape of the fronds was oval, with an unconspicuous, assymetric apex. The roots appeared normal, with lengths in the range of white light controls. After 42 days the colonies had 6 generations. The central and the 1st generation fronds were branched from both pockets. All the other fronds produced daughter fronds from the left pockets only. The colonies were rich in anthocyanins.

The effect of blue light was further studied by changing the composition of the medium. Since in many higher plants growth hormones often interact with light in eliciting morphogenetic phenomena, GA_3, IAA and kinetin were added in some experiments, in concentrations of 0.1 or 1.0 mg l^{-1}. The presence of hormones did not change the rosette–like habit of growth. Other parameters of growth were also not substancially changed.

The results concerning the effect of blue light on the morphology in *L. trisulca* are not similar to those reported by Zurzycki (1957). This author used low intensity coloured light (1000 erg cm^{-2} sec^{-1}). Since in the present paper only one intensity of irradiation was applied, it is not possible to conclude whether the different light conditions were the cause of different results. Red or blue light irradiations do not mimic the effect of hormones on growth of *L. trisulca.* On the other hand, the applied hormones were not capable of modifying the effect of light. Therefore, no interaction of hormones with blue or red light was established.

SUMMARY

Colonies of *Lemna trisulca* were cultivated in continuous fluorescent red (max. 660 nm) or blue (max. 460 nm) light, to study the possible morphogenetic effect of light. Red light did not modify the pattern of growth and the morphology of fronds, in comparison to white light–grown controls. Blue light, on the contrary, had a very strong

Fig. 1. – Aspect of colonies cultivated under continuous red (left) and blue (right) light; note the decreased size of fronds and very short petioles in blue light–irradiated colony.

effect on the elongation of petioles, and a weaker effect on the length of fronds. The petioles remained short, not exceeding 1–2 mm, which gave to the colonies the appearance of rosettes, or cushions. Kinetin, IAA, or GA_3 added to the medium did not change the aspect of the colonies, neither in red, nor in blue light. Therefore, it was not possible to establish any interaction of light of different wavelengths and the applied hormones.

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Rezime

JOVANKA BATA i MIRJANA NEŠKOVIĆ

EFEKAT SPOLJAŠNJIH FAKTORA NA RASTENJE I MORFOGENEZU LEMNA TRISULCA L. U STERILNOJ KULTURI. II. SVETLOST

Kolonije *Lemna trisulca* su gajene pod kontinualnim fluorescentnim osvetljenjem, crvenim (max. 660 nm), ili plavim (max. 460 nm), radi ispitivanja mogućih morfogenetskih efekata svetlosti. Crvena svetlost nije uticala na rastenje i morfologiju frondova, u poređenju sa kontrolom, gajenom na beloj svetlosti. Nasuprot tome, plava svetlost je veoma jako delovala na izduživanje petiola, a slabije na dužinu frondova. Petiole su ostajale vrlo kratke, ne prelazeći 1–2 mm, što je celoj koloniji davalo izgled rozete, ili jastučića. Kinetin, IAA, ili GA_3 dodati u podlogu, nisu menjali izgled kolonija, ni na plavoj, ni na crvenoj svetlosti. Na osnovu toga, nije bilo moguće utvrditi da postoji interakcija između svetlosti različitih talasnih dužina i hormona.