Thesis Title  Effects of Day Length and Red Light on Growth of Curcuma alismatifolia Gagnep. Rhizome

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Abstract

The study of day length and red light effect on growth and rhizome formation in Curcuma alismatifolia Gagnep. was carried out in four experiments.

Experiment 1 carried out on the rhizome formation under natural condition. Rhizome with 2.5 cm diameter and 4-5 storage roots were grown in media which comprised of sand : rice hull : rice husk charcoal (1:1:1). After shoot emerged, the plant was supplied with fertilizer solution at three times a week. Growth parameters, histological change and carbohydrates accumulation in rhizome and storage roots were recorded. The results showed that life cycle from planting until rhizome harvest was taken about 23 weeks. The process for rhizome formation could be separated into three stages, i.e. stage 1) initiation which occurred at about 11 weeks after planting when the vegetative growth reached it maximum. The concentration of total non structural carbohydrates in leaves started to decrease. On the other hand, plant increased in new rhizome and storage roots. Stage 2 was called differentiation and development of rhizome which occurred at 14-22 weeks after planting. The increase in cell number and cell enlargement occurred in new rhizome and storage roots. The accumulation of total non structural carbohydrates actively increased. Stage 3 was called maturation which occurred at 23 weeks after planting.
The growth was terminated when the concentration of total non structural carbohydrates was constant in rhizome and storage roots.

Experiment 2 was implemented on the rhizome formation *in vitro*. Explants were cultured in MS media with different sucrose concentrations i.e. 3, 4, 5 and 6%. The results showed that the percentage of rhizome formation tended to increase when using sucrose levels at 3 and 4% compared with 5 and 6%. Browning of plantlet also occurred at 6% sucrose.

Experiment 3 was on the effect of day length on growth and rhizome formation of *C. alismatifolia*. Plants were grown in controlled room at 27±2 °C, 70-80% RH, under different day lengths at 7, 10 and 13 hrs compared with natural light condition (control treatment). The results showed that day length at 7 hrs decreased number of plants per cluster, number of new rhizomes per plant and number of storage roots per rhizome. Flower abortion occurred under 7 and 10 hrs of day length conditions. Planting in controlled room increased plant chlorophyll fluorescence at 3 and 5 weeks after planting compared with control treatment. In addition, day length at 7 hrs decreased the concentration of total chlorophyll, chlorophyll a, chlorophyll b, reducing sugar and potassium in rhizome. The concentrations of total non structural carbohydrate, reducing sugar, phosphorus and potassium in storage roots were also reduced. The result from the DD RT-PCR showed the difference of RNA band when plants were grown under different day lengths.

Experiment 4 was on the effect of red light on growth and rhizome formation. Rhizomes of *C. alismatifolia* were grown in controlled rooms of when the same conditions were set as in experiment 3. When shoots emerged, plants were supplied with three different light sources i.e. 1) red light source (632-660 nm), 2) cool daylight source (410-812 nm) and 3) natural light condition (control treatment). The results showed that plants grown under the red light and cool day light were elongated and slimmer than those under the control treatment. The number of plants per cluster, number of leaves per plant, leave areas and photosynthetic rates were reduced under red light. Red light did not inhibit rhizome formation but decreased rhizome quality. Life cycle of plant grown under red light was also hastened. In addition, red light also reduced the concentration of total non structural
carbohydrates, and starch in rhizome total nitrogen and storage roots. The result from the DD RT-PCR showed that there were some differences in the RNA banding pattern when plants in grown under red light as compared with control.