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ORIGINAL ARTICLE

Effects of water-deficit stress and paclobutrazol on growth, relative water content, electrolyte leakage, proline content and some antioxidant changes in *Curcuma alismatifolia* Gagnep. cv. Chiang Mai Pink



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Abstract Effects of water-deficit stress and paclobutrazol (PBZ) on the physiological and biochemical changes in *Curcuma alismatifolia* Gagnep. cv. Chiang Mai Pink (Zingiberaceae) were investigated. One hundred rhizomes were grown for 30–35 days and then divided into the following 4 treatments: (1) well-watered, (2) not watered, (3) well-watered and treated with 1500 ppm PBZ being applied once to the soil, and (4) not watered but treated with 1500 ppm PBZ. After 50 days of growth, watering was withheld for 30 days. After water stress was initiated, plant height, plant fresh weight, soil water content, relative water content (RWC), electrolyte leakage (EL), proline content, vitamin C and E content, as well as the activities of catalase (CAT) and superoxide dismutase (SOD) in the leaves were determined every 10 days. The results showed that water-deficit stress decreased plant height and plant fresh weight, whereas this stress and PBZ did not result in a decrease in these parameters. Water stress reduced RWC, but induced EL and proline content in the leaves. However, the leaves showed opposite results when PBZ was added to the treatments. Some antioxidants such as vitamin C, vitamin E, and the activities of CAT and SOD were induced in the leaves by PBZ. Moreover, the content of vitamin C, vitamin E and CAT activity were higher in relation to water-deficit stress and PBZ treatments. This indicates that PBZ induced a number of

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some physiological and biochemical adaptations (maintaining growth and RWC, decreasing EL and proline content, increasing the vitamin C and vitamin E levels, and CAT and SOD activities) that enable the *Curcuma* plant to tolerate drought.

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1. Introduction

Curcuma alismatifolia Gagnep. cv. Chiang Mai Pink (Zingiberaceae), or Patumma in the Thai language, is an economically important plant species in Thailand. It is an ornamental plant with a variety of shapes and colors of the bracts and is popular for cut-inflorescence and ornamental purposes in plots and gardens (Songhongsa, 2014). Potted plants can be moved easily and are commonly used as a form of decoration in many places, both inside structures and surrounding buildings and gardens (Fig. 1). To make potted plants shorter, plant growth regulators are needed. Paclobutrazol or PBZ [(2RS,3RS)-1-(4-chlorophenyl-4,4-dimethyl-2-(1H-1,2,4 triazol-1-yl)pentan-3-ol)] is a plant growth retardant

which blocks three steps in the terpenoid pathway for the production of gibberellins (Fletcher et al., 2000). One of the main roles of gibberellins in plants is the stimulation of cell elongation. When gibberellin production is inhibited, cell division still occurs, but the new cells do not elongate, resulting in stems with the same number of leaves and shorter internodes (Pinto et al., 2006; Francescangeli and Zagabria, 2008). For these reasons, PBZ is used to reduce plant height for potted plant production in several species (Pinto et al., 2006; Francescangeli and Zagabria, 2008; Hua et al., 2014; Wanderley et al., 2014). PBZ has been reported as an ameliorated compound when plants are subjected to salinity or water-deficit stresses. This occurs as a result of the reduction of malondialdehyde (MDA), electrolyte leakage (EL) and

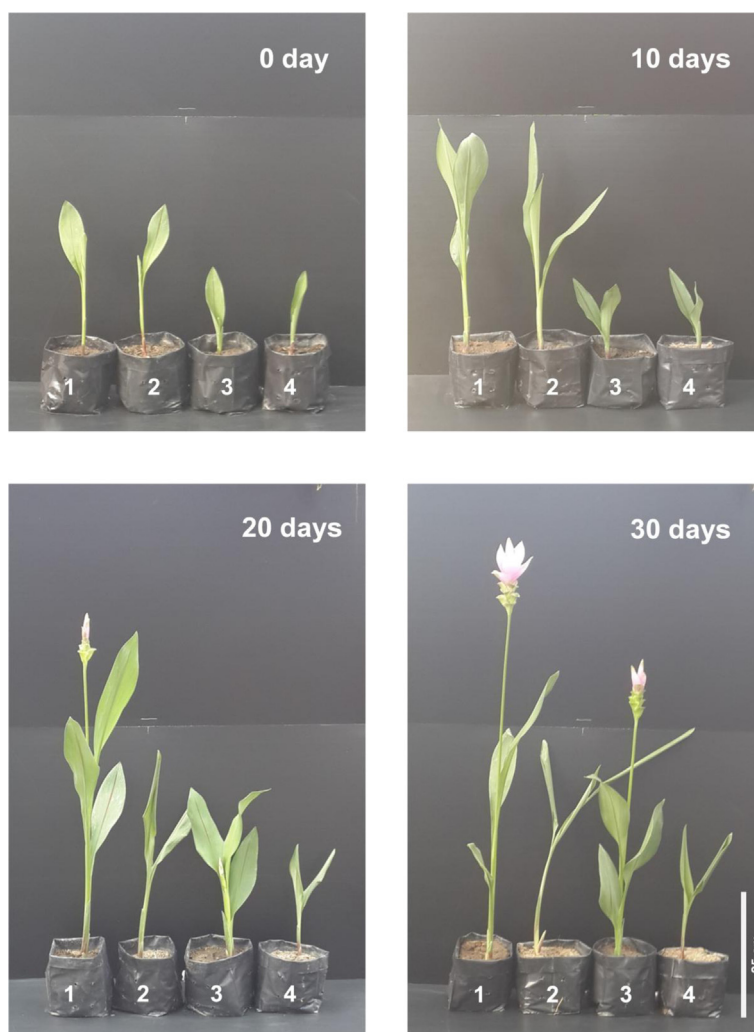


Figure 1 Treatments of *Curcuma alismatifolia* Gagnep. cv. Chiang Mai Pink; (1) well-watered, (2) no water, and (3) well-watered + 1500 ppm PBZ and (4) no water + 1500 ppm PBZ after withholding water for 0–30 days.

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