

บทบาทของเอทิลีนต่ออายุการปักแจกันของดอกบัวหลวง 'บุญทรริก'
Role of ethylene on vase-life of sacred lotus flower (*Nelumbo nucifera* Gaertn)

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Abstract

Role of ethylene on senescence and vase-life of sacred lotus (*Nelumbo nucifera* Gaertn) cv. 'Boondharik' flower was investigated. Sacred lotus flower was treated with 500 ppm ethephon for 3 hours before fumigating with 0, 200, 400, 600 and 800 nLL⁻¹ 1-MCP for 4 hours, compared with 200 nLL⁻¹ 1-MCP and deionized water (control). Treated sacred lotus flower was held in deionized water at ambient temperature (29-30 C). The results showed that ethephon induced premature senescence of sacred lotus flower. Ethephon also increased water uptake, whereas 1-MCP reduced water uptake and weight loss, delayed browning and prolonged vase-life of sacred lotus treated flower. However, 1-MCP slightly affected ethylene action, when the sacred lotus flower was treated with ethephon prior to 1-MCP.

Key word: Ethylene Vase-life Sacred lotus

บทคัดย่อ

บทบาทของเอทิลีนต่อการเสื่อมสภาพและอายุการปักแจกันของดอกบัวหลวง 'บุญทรริก' (*Nelumbo nucifera* Gaertn cv. 'Boondharik') โดยการแช่ดอกบัวในสารละลายเอทิฟอน 500 ppm นาน 3 ชั่วโมง ก่อนรม 1-MCP (0, 200, 400, 600 และ 800 nLL⁻¹) นาน 4 ชั่วโมง เปรียบเทียบกับดอกบัวที่ไม่ได้รับสาร และ 1-MCP 200 nLL⁻¹ แล้วนำมาปักแจกันในน้ำกลั่นที่อุณหภูมิห้อง (29°-30°ซ.) พบว่า เอทิลีนเร่งการเสื่อมสภาพของดอกบัว เอทิฟอนชักนำให้ดอกบัวหลวงเสื่อมสภาพ กระตุ้นการดูดน้ำเพิ่มขึ้น ส่วน 1-MCP จะลดการดูดน้ำและลดการสูญเสียน้ำหนัก จะลดการเปลี่ยนสีของกลีบดอกและยืดอายุการปักแจกัน อย่างไรก็ตามการให้ 1-MCP ภายหลังจากที่ดอกได้รับสารละลายเอทิฟอน จะลดการทำงานของเอทิลีนลงได้น้อย ไม่เด่นชัด

คำสำคัญ: เอทิลีน, อายุการปักแจกัน, บัวหลวง

Introduction

Sacred lotus flower (*Nelembo nucifera* Gaert.) is one of commercial cut flower in Thailand as its demand around the year. Its also a potential cut flower exporting to worldwide, for example Austria, United State and Japan (Uorasa and Thanoumnuan, 2005). There are 4 important cultivars, 'Sattabongkot', 'Pathumma', 'Saddhabutra' and 'Boondharik'. The sacred lotus cv. 'Boondharik' is oval white-greenish medium flower. It is generally decorated and worshiped in religious purposes. All of lotus cultivar, including 'Boondharik', had short vase-life, which their petals dehydrated and abscised in a few days. The petal turned to pale yellow and brown. Deterioration of lotus derived from complicated causes. Water stress probably induced by occlusion in xylem of peduncle. In cortex of peduncle contained 2-3 layers of sclerenchyma, lactiferous duct and inserted with aerenchyma (Jaree, 1976). The growers detached peduncle from rhizome by hand (Kaneungnit, 2001). Lactiferous probably leaked and released latex, therefore water conduction was slow down. Otherwise, wounded peduncle excreted suberin, tanin, or gum (Van Doorn and Perik, 1990). Afterwards, grower usually took a few hours to collect and pack flower had caused more water stress effect. When wet cotton was wrapped the

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peduncle, flower were longer vase-life (Roongtiwa, 2001). Wounding was also enhanced ethylene production and accelerated senescence. Kaneungnit (2001) improved postharvest process for sacred lotus 'Sattabongkot', resulting low ethylene evolution and extending vase-life. However, 8-Hydroxyquinoline sulfate (8-HQS), silver thiosulfate (STS), 6-Benzylaminopurine (BA), abscissic acid (ABA), sucrose and pH adjustment (pH 3-4), did not reduce ethylene production in sacred lotus flower. Nowadays, 1-methylcyclopropene (1-MCP), ethylene action inhibitors, delayed senescence and led to widespread commercial use in many crops. 1-MCP is also used as a tool to explore the role of ethylene for advance understanding in plant response. This finding traced role of ethylene on vase-life and deterioration of sacred lotus cv. 'Boondharik'.

Material and Methods

Sacred lotus were fumigated with 1-MCP 200 nLL⁻¹ for 4 hours or held in ethephon at 500 ppm for three hours then were fumigated with 1-MCP at 0, 200, 400, 600 and 800 nLL⁻¹ for 4 hours. All of them were compared with sacred lotus held in deionized water as control. Afterwards, treated sacred lotus was held in deionized water at ambient temperature. The experiments were designed in completely randomized design with 12 replications. We observed on weight loss, water uptake, fresh weight, browning, petal color (L*, a* and b*) and vase-life.

Result and Discussion

Ethephon enhanced water uptake in sacred lotus in the first day. So it lost its weight lower than control. Ethylene raised more respiration and more transpiration. Addition, Ethylene also accelerated membrane breakdown and senescence. Generally, sacred lotus maintained its turgor pressure via taking much water uptake to sustain its pressure. In contrast, 1-MCP reduced water uptake. However, 1-MCP treated flower had lower weight loss than control in the first day, which 1-MCP depressed ethylene effects, particularly respiration. 1-MCP also maintained fresh weight. Blankenship and Dole (2003) reported that 1-MCP reduced respiration in many crops. 1-MCP treated flower absorbed less water than flower treated with ethephon as well as control. Nevertheless, sacred lotus flower was treated with ethephon in the first three hours and then be fumigated with various 1-MCP concentrations, 1-MCP slightly retarded water uptake. 1-MCP also delays membrane deterioration. Flower treated with 1-MCP was continuously consumed water through its vase-life. Flower usually conducted much water in the first day and gradually declined. Serek *et al.* (1994) revealed that three begonia cultivars treated with 1-MCP reduced abscission and slowly respond to ethylene. As the findings, ethylene accelerated water uptake. This implied that water stress was not brought to deteriorate. Ethylene initiated premature senescence and shorten vase-life. Sacred lotus petals were pale greenish and turned to pale yellow and then brown. In general, sacred lotus vase-life last 2-3 days. Ethylene hastened petal color to browning within 1-2 days after holding in ethephon for three hours. Whereas, 1-MCP tended to delay browning, probably ethylene encourages polyphenol oxidase to polymerize phenolic substances. Afterwards, sacred lotus petal turned browning and dehydration. We founded that ethylene treated flower had vase-life 1.7 days, which shorter than control for a day. In other hand, 1-MCP prolonged vase-life to 2.5 days. Conversely, 1-MCP slightly affected ethylene action, when the sacred lotus was treated with ethephon prior to 1-MCP. According to biochemical and physiological characteristics, sacred lotus flower had short vase-life. Sacred lotus flower produced high ethylene. Probably its accumulated aminocyclopropane-1-carboxylic acid (ACC), an intermediate substance in ethylene production, which aquatic and submerge plants usually does, such as deep water rice (Kende *et al.*, 1998) and *Rumex* sp. (Cox *et al.*, 2004), including lotus. Mostly aquatic plants usually accumulated ACC to prompt response environment during growth and development. Sacred lotus petals were dehydrated prior to abscission during senescence, probably it exposed high ethylene since its was been immature and developed flower.

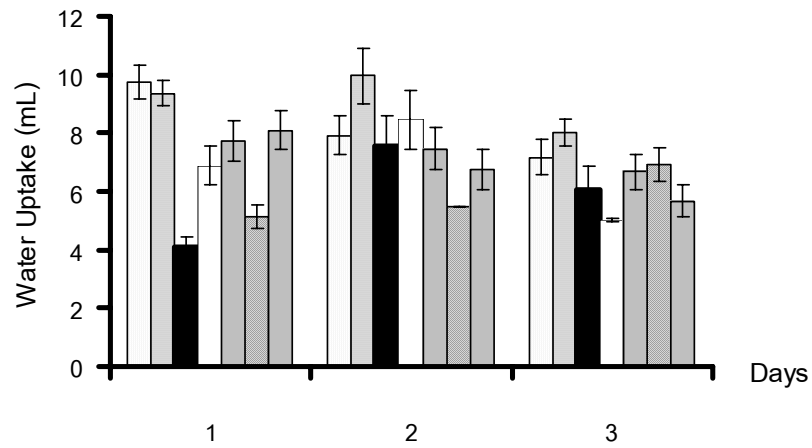


Figure 1 Water uptake of sacred lotus cv. 'Boondharik' treated with 1-MCP and/or ethephon at ambient temperature

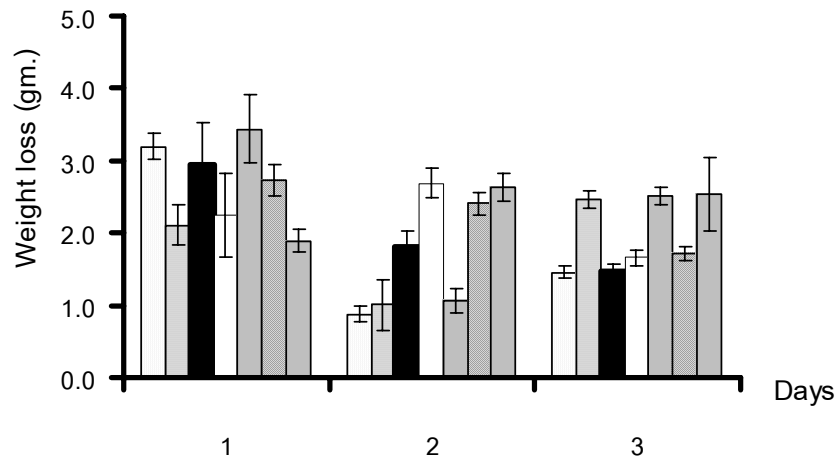


Figure 2 Weight loss of sacred lotus cv. 'Boondharik' treated with 1-MCP and/or ethephon at ambient temperature

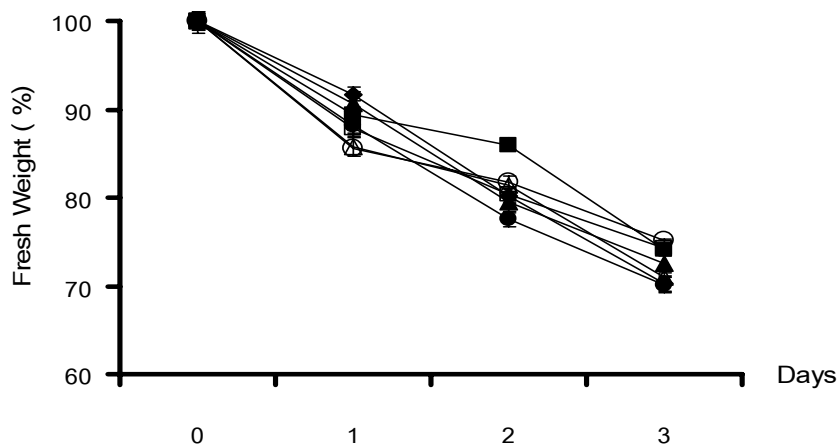


Figure 3 Fresh weight of sacred lotus cv. 'Boondharik' treated with 1-MCP and/or ethephon at ambient temperature

Table1 Vase-life of sacred lotus cv. 'Boondharik' treated with 1-MCP and/or ethephon at ambient temperature

| Treatments | Vase-life (Days) |
|--|------------------|
| Control | 2.17ab |
| ethephon 500 ppm | 1.7c |
| 1-MCP 200 nLL ⁻¹ | 2.50a |
| ethephon 500 ppm+1-MCP 200 nLL ⁻¹ | 2.08abc |
| ethephon 500 ppm+1-MCP 400 nLL ⁻¹ | 2.00bc |
| ethephon 500 ppm+1-MCP 600 nLL ⁻¹ | 2.00bc |
| ethephon 500 ppm+1-MCP 800 nLL ⁻¹ | 2.08abc |
| F-test | * |
| % C.V. | 20.32 |

Conclusion

Ethylene played important role on senescence and vase-life of sacred lotus. Sacred lotus was fumigated with 200 nLL⁻¹ 1-MCP for 4 hours and was held in deionized water at ambient temperature (29-30 C), had vase-life 2.5 days. Ethephon induced premature senescence of sacred lotus flower. Ethephon was also increased water uptake, whereas 1-MCP reduced water uptake and weight loss, delayed browning and prolonged vase-life of sacred lotus treated. Nonetheless, 1-MCP slightly affected ethylene action, when the sacred lotus was treated with ethephon prior to 1-MCP

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