茉莉酸參與日本朝顏花朵受到機械性創傷後所誘導的老化機制

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摘 要

老化過程是植物生長週期的一部份，假如能夠詳細的瞭解花朵老化的過程，將有助於花卉運輸過程和保存處理技術的提升，進而延長花卉觀賞期和增加販售價值。花朵老化是一個快速的過程，除了老化生化反應的進行，這些老化生化反應也受到外界環境的刺激和影響；例如授粉（pollination）、機械性創傷 （wounding）。本研究利用日本朝顏（Ipomoea nil）探討機械性創傷誘導花朵老化，和花朵正常老化之差異，及可能的訊號路徑傳遞。研究成果顯示，在固定生長條件下生長之日本朝顏，其開花時間大約持續6小時（在此指開花後6小時，開始出現可見萎凋徵狀）；經過機械性創傷之處理後（移除雄蕊、移除花柱、同時移除花柱和雄蕊、花瓣處理0.5 cm長的切傷），其開花時間則縮短至3小時。以100 μM的茉莉酸（jasmonic acid, JA）處理剛完全開花的日本朝顏花朵，其開花時間縮短至大約3小時，與機械性創傷處理的花朵開花時間大致相當，且花朵萎凋外觀也相似於以機械性創傷處理之花朵。但是若先以濃度1 mM的阿斯匹靈（2-acetoxybenzoic acid, ASP）處理剛開花的花朵，抑制茉莉酸生合成，而後再進行花朵機械性創傷處理或以100 μM的茉莉酸處理，結果發現開花時間回復為大約6小時。除了外加阿斯匹靈有這種回復效果外，外加濃度0.01% (w/v) 乙烯（ethylene）生合成抑制劑2-aminoethoxyvinylglycine (AVG)，也有同樣的回復效果。綜合試驗結果顯示，乙烯（ethylene）和茉莉酸（jasmonic acid）的訊號路徑，可能與日本朝顏花朵因受到機械性創傷所導致的提早萎凋反應有關。

關鍵詞 : 茉莉酸、乙烯、日本朝顏、豐樂果、阿斯匹靈

目錄

參考文獻

1.Andrew D. Hanson, Hans Kende. Ethylene-enhanced ion and sucrose efflux in morning glory flower tissue. Plant Physiology 1975; 55:663-669. 2.Creelman RA, Mulet JE. Biosynthesis and action of jasmonates in plants. Plant Physiology and Plant Molecular Biology 1997; 48: 355-381. 3.Emilia Wilmowicz, Jacek Kesy, Jan Kopcewicz. Ethylene and ABA interactions in the regulation of flower induction in Pharbitis nil. Journal of Plant Physiology 2008; 165: 1917-1928. 4.Farmer, E.E., Weber ,H. and Vollenweider, S. Fatty acid signaling in Arabidopsis. Panta 1998; 206: 167-174. 5.Enrique Rojo, Roberto Solano and Jose J. Sanchez-Serrano. Interactions between signaling compounds involved in plant defense. Journal of Plant Growth Regulation 2003; 22:82-98. 6.Ernst J. Woltering, Dianne Somhorst, and Pieter van der Veer. The role of ethylene in interorgan signaling during flower senescence. Plant Physiology 1995; 109: 1219-1225. 7.Filip Rolland, Brandon Moore, and Jen Sheen. Sugar sensing and signaling in plants. The Plant Cell 2002; 14: 185-205. 8.Gregg A. Howe. Jasmonates as signals in the wound response. Journal of Plant Growth Regulation 2004; 23: 223-237. 9.Guy Tanari, Amihud Borochow, Rainer Atzom, David Weiss. Methyl jasmonate induces pigmentation and flavonoid gene expression in petunia corollas: Apossible role in wound response. Physiologia Plantarum 1995; 94: 45-50. 10.Iris A. M. A. Penninckx, Bart P. H. J. Thomma, Antony Buchala, Jean-Pierre Metraux, and Willem F. Broekaert. Concomitant activation of jasmonate and ethylene response pathways is required for induction of a plant defensin gene in Arabidopsis. The Plant Cell 1998; 10: 2103-2113. 11.Jacek Kesy, Beata Maciejewska, Magdalena Sowa, Magdalena Szumilak, Krzysztof K awalowski, Maja Borzuchowska, Jan Kopcewicz. Ethylene and IAA interactions in the inhibition of photoperiodic flower induction of Pharbitis nil. Plant Growth Regulation 2008; 55: 43-50. 12.Kazuo Ichimura, Kenichi Suto. Role of ethylene in acceleration of flower senescence by filament wounding in Portulaca hybrid. Physiologia Plantarum 1998; 104: 603-607. 13.Kenichi Shibuya, Tetsuya Yamada, Tomoko Suzuki, Keiichi Shimizu, and Kazuo Ichimura. InPSR26, aputative membrane protein, regulates programmed cell death during petal senescence in Japanese morning glory. Plant Physiology 2009; 149: 816-824. 14.Lucia C. Strader, Erin R. Beisner, and Bonnie Bartel. Silver ions increase auxin efflux independently of effects on ethylene response. The Plant Cell 2009; 21: 3585-3590. 15.Margrethe Serek, Rodney B. Jones, and Michael S. Reid. Role of ethylene in opening and senescence of Gladiolus sp. Flowers. J. Amer. Soc. Hort. Sci. 1994; 119: 1014-1019. 16.Michael S. Reid, Men-Jen Wu. Ethylene and flower senescence. Plant Growth Regulation 1992; 11:37-43. 17.Oscar Lorenzo, Raquel Piqueras, Jose J. Sanchez-Serrano, and Roberto. Ethylene response factor 1 integrates signals from ethylene and jasmonate pathways in plant defense. The Plant Cell 2003; 15: 165-178. 18.Porat R., A Borochov, A.H. Halevy. Enhancement of petunia and dendrobium flower senescence by jasmonic acid methyl ester is via the promotion of ethylene production. Plant Growth Regulation 1993; 13: 297-301. 19.Punita Nagpal, Christine M. Ellis, Hans Weber, Sara E. Ploense, Lana S. Barkawi, Thomas J. Guilfoyle, Gretchen Hagen, Jose M. Alonso, Jerry D. Cohen, Edward E. Farmer, Joseph R. Ecker and Jason W. Reed. Auxin response factors ARF6 and ARF8 promote jasmonic acid production and flower maturation. Development 2005; 132: 4107-4118. 20.Saniewski M, Miyamoto K, Ueda J. Gum formation by methyl jasmonate in tulip shoots is stimulated by ethylene. Plant Growth Regulation 1998; 17: 179-183. 21.Sharif, J., Muto, M., Takebayashi, S.I., Suetake, I., Iwamatsu, A., Endo, T.A., Shinga, J., Mizutani-Koseki, Y., Toyoda, T., Okamura, K. The SRA protein Np95 mediates epigenetic inheritance by recruiting Dnmt1 to methylated DNA. Nature 2007; 450: 908 – 912. 22.Shuangyi Bai, Belinda Willard, Laura J. Chapin, Michael T. Kinter, David M. Francis, Anthony D. Stead and Michelle L. Jones. Proteomic analysis of pollination-induced corolla senescence in petunia. Journal of Experimental Botany 2010; 61: 1089-1109. 23.Stead AD. Pollination-induced flower senescence: a review. Plant Growth Regulation 1992; 11: 13-20. 24.Stead AD, van Doorn W. Strategies of flower senescence- a review. Molecular and cellular aspects of plant reproduction. 1994; 55: 215-237. 25.Sven Verlinden, William R. Woodson. The physiological and molecular responses of carnation flowers to high temperature. Postharvest Biology and Technology 1998; 14: 185-192. 26.Trobacher P. Ethylene and programmed cell death in plants. Botany 2009; 87: 757-769. 27.Wouter G., Van Doorn. Effect of ethylene on flower abscission: a survey. Botany 2002; 89: 689-693. 28.Yeong- Biau Yu and Shang Fa Yang. Auxin-induced ethylene production and its inhibition by aminoethoxyvinylglycine and cobalt ion. Plant Physiology 1979; 64: 1074-1077. 29.Yuan Zhong and Claire Ciafre. Role of ABA in ethylene- independent Iris flower senescence. International Conference on Food Engineering and Biotechnology.