

Title Jasmonates are essential factors inducing gummosis in tulips: mode of action of jasmonates focusing on sugar metabolism

Author Edyta Skrzypek, Kensuke Miyamoto, Marian Saniewski and Junichi Ueda

Citation Journal of Plant Physiology, Volume 162, Issue 5, 13 May 2005, Pages 495-505

Keywords Ethylene; Glucuronoarabinoxylan; Gummosis (gum formation); Jasmonate; Jasmonic acid; Methyl jasmonate; Sugar metabolism; *Tulipa gesneriana*

### Abstract

The purpose of this study was to know the mechanism of jasmonates to induce gummosis in tulip (*Tulipa gesneriana* L. cv. Apeldoorn) shoots, especially on the focus of sugar metabolism. Gummosis in the first internode of tulip plants was induced by the application of methyl jasmonate (JA-Me, 1% w/w in lanolin) and jasmonic acid (JA, 1% w/w in lanolin) 5 days after application and strongly stimulated by the simultaneous application of ethylene-releasing compound, ethephon (2-chloroethylphosphonic acid, 1% w/w in lanolin), although ethephon alone had little effect. JA-Me stimulated ethylene production of the first internodes of tulips, ethylene production increasing up to more than 5 times at day 1 and day 3 after the application. On the other hand, application of ethephon did not increase endogenous levels of jasmonates in tulip stems. Analysis of composition of tulip gums revealed that they were consisted of glucuronoarabinoxylan with an average molecular weight of ca. 700 kDa. JA-Me strongly decreased the total amount of soluble sugars in tulip stems even in 1 day after application, being ca. 50% of initial values 5 days after application, but ethephon did not. However, both JA-Me and ethephon had almost no effect on the neutral sugar compositions of soluble sugars mainly consisting of glucose, mannose and xylose in ratio of 20:2:1 and traces of arabinose. Both JA-Me and ethephon applied exogenously stimulated senescence of tulip shoots shown by the loss of chlorophyll. These results strongly suggest that the essential factor of gummosis in tulips is jasmonates affecting the sugar metabolism in tulip shoots. The mode of action of jasmonates to induce gummosis of tulip shoots is discussed in relation to ethylene production, sugar metabolism and senescence.

**Abbreviations:** Ethephon, 2-chloroethylphosphonic acid; JA, jasmonic acid; JA-Me, methyl jasmonate