Abstract

To study the role of calcium ions in the gravitropic response of cut flowering shoots, we have examined the effects of various calcium modulators on stem bending of *Ornithogalum* spp. 'Nova' spikes following dry or wet gravistimulation. The most effective calcium chelators were further examined for their effects on the gravity- or IAA-induced ethylene formation, which represent signal transduction events in the gravity signalling pathway. The calcium chelators 1,2-bis(2-aminophenoxy)ethane-*N*,*N*,*N*′,*N*′-tetraacetic acid (BAPTA), ethylene glycol bis(β-aminoethylether) *N*,*N*,*N*′,*N*′-tetraacetic acid (EGTA), *trans*-1,2-cyclohexane dinitro-*N*,*N*,*N*′,*N*′-tetraacetic acid (CDTA), ethylenediamine-tetraacetic acid (EDTA), and the calcium channel blocker $LaCl_3$, inhibited the gravitropic bending of *Ornithogalum* 'Nova' spikes. This bending inhibition was obtained following stem gravistimulation both under dry transport (48 h dark at 6 °C) or laboratory (24 h light at 20 °C) conditions. On the other hand, the calcium ionophore A23187 enhanced the gravitropic response, further supporting the role of intracellular calcium in the gravitropic bending response. These calcium modulators had no deleterious effects on the flowering shoot, indicating that their inhibitory effect is not due to damage. An ethylene gradient was developed across the gravistimulated flowering shoot prior to the visual bending response, in favour of the lower stem flank. This was correlated with higher levels of 1-aminocylclopropane-1-carboxylic acid (ACC) and 1-(malonylamino)-cyclopropane-1-carboxylic acid (MACC) at the lower flank, indicating that the gravitropic stimulus may either lead to activation of ethylene biosynthesis enzymes or to lateral ACC movement. The ethylene gradient was abolished following spikes pulsing with EGTA or CDTA, which prevented the increased ethylene production at the lower flank. CDTA also abolished the IAA-induced ethylene production in vertical stems. This may imply that the calcium chelators inhibit ethylene production of the lower flank via inhibition of IAA action, which induces increased ethylene formation. This indicates that the calcium chelators act upstream to activation of ethylene biosynthesis, probably by abolishing earlier gravity-related processes. Our results further support our previous findings in snapdragon that calcium may act as an important mediator of the gravitropic signal transduction mechanism in cut flowering shoots.