

# Effects of low-energy argon ion implantation on the dynamic organization of the actin cytoskeleton during maize pollen germination

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Genet. Mol. Res. 9 (2): 785-796 (2010)

Received January 12, 2010

Accepted February 12, 2010

Published April 27, 2010

DOI 10.4238/vol9-2gmr768

**ABSTRACT.** The relationship between pollen germination and the dynamic organization of the actin cytoskeleton during pollen germination is a central theme in plant reproductive biology research. Maize (*Zea mays*) pollen grains were implanted with 30 keV argon ion (Ar<sup>+</sup>) beams at doses ranging from  $0.78 \times 10^{15}$  to  $13 \times 10^{15}$  ions/cm<sup>2</sup>. The effects of low-energy ion implantation on pollen germination viability and the dynamic organization of the actin cytoskeleton during pollen germination were studied using confocal laser scanning microscopy. Maize pollen germination rate increased remarkably with Ar<sup>+</sup> dose, in the range from  $3.9 \times 10^{15}$  to  $6.5 \times 10^{15}$  ions/cm<sup>2</sup>; the germination rate peaked at an Ar<sup>+</sup> dose of  $5.2 \times 10^{15}$  ions/cm<sup>2</sup>. When the implantation dose exceeded  $7.8 \times 10^{15}$  ions/cm<sup>2</sup>, the rate of pollen germination decreased sharply. The actin filaments assembled in pollen grains implanted with  $5.2 \times 10^{15}$  ions/cm<sup>2</sup> Ar<sup>+</sup> much earlier than in controls. The actin filaments organized as longer parallel bundles and extended into the emerg-

ing pollen tube in treated pollen grains, while they formed random and loose fine bundles and were gathered at the pollen aperture in the control. The reorganization of actin cytoskeleton in the pollen implanted with  $9.1 \times 10^{15}$  ions/cm<sup>2</sup> Ar<sup>+</sup> was slower than in controls. There was a positive correlation between pollen germination and the dynamic organization of the actin cytoskeleton during pollen germination. Ion implantation into pollen did not cause changes in the polarization of actin filaments and organelle dynamics in the pollen tubes. The effects of Ar<sup>+</sup> implantation on pollen germination could be mediated by changes in the polymerization and rearrangement of actin polymers.

**Key words:** Maize pollen; Low-energy ion implantation; Pollen germination; Actin cytoskeleton