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Fine-tuning of SUMOylation modulates drought tolerance of apple

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摘要	SUMOylation is involved in various aspects of plant biology, including drought stress. However, the relationship between SUMOylation and drought stress tolerance is complex; whether SUMOylation has a crosstalk with ubiquitination in response to drought stress remains largely unclear. In this study, we found that both increased and decreased SUMOylation led to increased survival of apple (Malus?×?domestica) under drought stress: both transgenic MdSUMO2A overexpressing (OE) plants and MdSUMO2 RNAi plants exhibited enhanced drought tolerance. We further confirmed that MdDREB2A is one of the MdSUMO2 targets. Both transgenic MdDREB2A OE and MdDREB2AK192R OE plants (which lacked the key site of SUMOylation by MdSUMO2A) were more drought tolerant than wild-type plants. However, MdDREB2AK192R OE plants had a much higher survival rate than MdDREB2A OE plants. We further showed SUMOylated MdDREB2A was conjugated with ubiquitin by MdRNF4 under drought stress, thereby triggering its protein degradation. In addition, MdRNF4 RNAi plants were more tolerant to drought stress. These results revealed the molecular mechanisms that underlie the relationship of SUMOylation with drought tolerance and provided evidence for the tight control of MdDREB2A accumulation under drought stress mediated by SUMOylation and ubiquitination.
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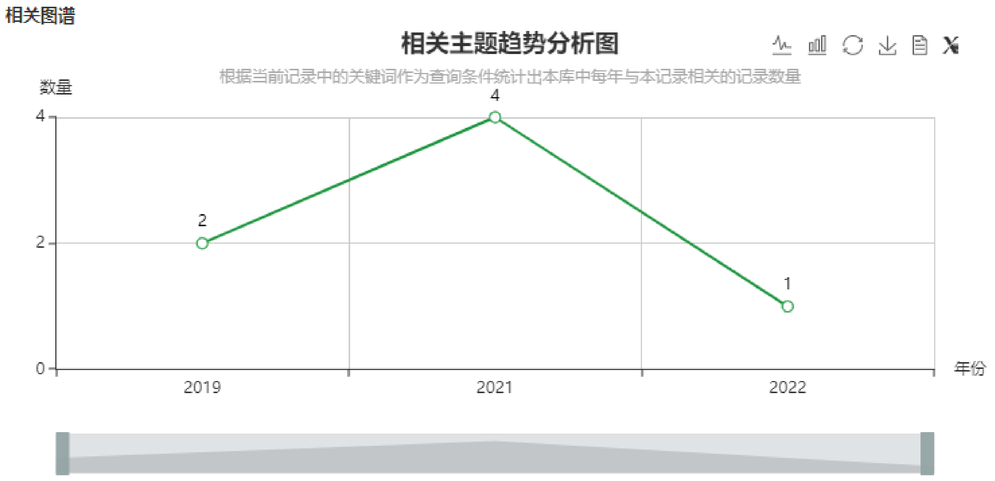

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