Functions of jasmonates upon potato tuberization

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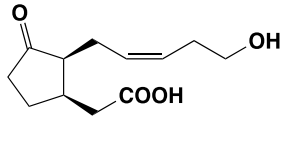
Introduction: Potato (*Solanum tuberosum*) is one of the most important crops. Area for cultivating potato is limited due to its strict responsiveness to day length. In long day condition, stolons, which are a kind of stem in underground part, tend to elongate horizontally. When the leaflets are exposed to short day condition, the tip of stolon starts to swell resulting into potato tuber. It was found that reduction of activity of Gibberellin (GA) was pivotal event for tuberization. It was also found that jasmonic acids (JAs), which were well known to have key rolls in wounding response in plant, have tuber inducing activity in vitro. Since JAs are mainly biosynthesized in aerial part, it was predicted that systemic transport of JAs should be on work. Further more, some reports suggested the antagonistic effect of JAs against GA, although it is still unclear the detailed mechanism how JAs affect GA.

Aim: This research aims to clarify the mechanism of tuberization focusing on the systemic transport of JAs and the relationship between JAs and GA.

Methods: 1, Analysis of JAs in potato: Potato plants derived from the hollowed potato tuber containing one bud in one tissue grew for 2weeks in long day condition in a plant growth chamber and then half of them were transferred to short day condition. Endogenous amount of JAs in stem exudates and tuber were measured using UPLC-MS/MS. Systemic transport of JAs were evaluated by applying JA-d_3, JA-d_6 and tuberonic acid (TA)-d_5 on the leaflet. Bioassay for tuber inducing activity: Tuber inducing activity of TA was evaluated using single-node stem segments (Koda and Okazawa, 1988). Confirmation of acceptable TA concentration for the activity test was conducted with UPLC-MS/MS. GA contents of obtained samples were measured by Institute of Physical and Chemical Research. qRT-PCR analysis was carried out to examine the transcriptional level of GA synthesis/degradation(*GA2ox1*, *GA3ox2*, *GA20ox1* and *GA20ox3*) genes.

Results and Discussion: Under the long day condition, tuberization was not observed until 17 days. On the other hand tuber was developed in about 10 days in short day condition. Analysis of stem exudates in 10 days revealed that TA was significantly transferred from aerial to underground parts. Besides this, in the shrot day condition, a significant level of TA-d_5 was presented in stem exudates and developing tubers of the sample in the experimental case of being applied JA-d6 on the leaf. These results showed that TA was the main signaling conpound of tuberization. In tuber inducing test in vitro, TA showed the activity in the concentration of 10 μM. Since the profile of JAs of obtained node stem tissue was almost as same as those of a tuber cultivated in the greenhouse, the amount of applying 10 μM is the acceptable concentration to establish biologically relevant event. From the results of qRT-PCR analysis using 10 μM TA, it was found that the target to show antagonistic activity of TA was upon degradation step of GA active form.



TA

Fig. Chemical structure of tuberonic acid.

Key Words: plant hormone, potato, tuberization, jasmonate, gibberellin

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