Effect of Coronatine on Stomatal Opening in Leaves of Broadbean and Italian Ryegrass

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Sakai *et al.*^{1,2)} reported that coronatine, a toxin produced by *Pseudomonas syringae* pv. *atropurpurea*, induced marked hypertrophy on potato tuber discs, accompanied by rapid disappearance of starch granules. On the other hand, Turner and Graniti³⁾ reported that fusicoccin, a toxin produced by *Fusicoccum amygdali*, had a physiological activity to enhance stomatal opening. The present work was done to elucidate whether coronatine affects stomatal opening as one of its functions.

Broadbean (*Vicia faba*, cv. Nintoku) and Italian ryegrass (*Lolium multiflorum*, cv. Giant) were grown in a green house for 20 days. The discs (1.6 cm in diameter) from third leaves of broadbean and the third leaf blades (2 cm from the top) of Italian ryegrass were used for this experiment. These samples were placed in Petri dishes and kept in the dark for 1.5 hr to make stomata close. The lower surface of these leaf segments were contacted with coronatine solution in a Petri dish and placed in the dark. Distilled water was used as control. After the treatments stomata were replicated on celluloid films after removal of excess water with a filter paper. Twenty five films in each experimental plot were observed under a light microscope. As shown in Fig. 1, stomatal aperture of broadbean was determined by subtracting B from A (A-B),

Fig. 1. Parameters for stomatal aperture. The width A-B was measured for broadbean and the width C for Italian ryegrass.

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Fig. 2. Effect of coronatine concentrations on stomatal aperture of broadbean. Stomatal aperture was expressed as the width A-B (cf. Fig. 1).

Fig. 3. Time course of coronatine treatment on stomatal aperture of broadbean. Leaves were incubated with 10^{-6} M coronatine solution at 24°C. Stomatal aperture was expressed as the width A-B (cf. Fig. 1).

Fig. 4. Effect of coronatine on stomatal aperture of Italian ryegrass. Leaves were treated with 10^{-6} M coronatine solution for 1.5 hr at 24°C. Stomatal aperture was determined as the width C (cf. Fig. 1).

because the width C was not replicated clearly due to the stomatal structure with a deep hollow. On the other hand, stomatal aperture of Italian ryegrass was determined as the width C.

Effects of concentration and treatment time. As shown in Fig. 2, stomatal aperture of broadbean was increased with increasing concentrations of coronatine until maximum was attained at 10^{-6} M. Its effect was somewhat lessened at the concentrations higher than 10^{-6} M. As shown in Fig. 3, stomatal opening was initiated 1 hr after treatment with 10^{-6} M coronatine.

Effect of coronatine on Italian ryegrass. As shown in Fig. 4, stomatal aperture was increased markedly by treatment with 10^{-6} M coronatine.

Coronatine was shown to enhance stomatal opening of broad bean and Italian ryegrass in this study. Turner and Graniti³⁾ reported that absorption of potassium ions into guard cells was increased by fusicoccin, resulting in stomatal opening. In the light of the activation of membrane bound ATPase by coronatine⁴⁾, stomatal opening by coronatine may be exerted through the same mechanism as that found with fusicoccin³⁾. Sakai *et al.*²⁾ reported that starch granules in potato tuber discs were decomposed actively after coronatine treatment, leading to the increase in osmotic pressure in the cells. There is therefore a possibility that the increase in osmotic pressure in the guard cells caused by decomposition of starch granules is partly responsible for stomatal opening. These problems will be clarified by further experiments.

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和 文 摘 要

美濃羊輔・松下恭樹・酒井隆太郎：インゲンおよびイタリアンライグラス葉上の気孔の開口におよぼすコロナチンの影響

ソラマメおよびイタリアンライグラスの葉を用いて、気孔の開口におよぼすコロナチンの影響を調べた。ソラマメの気孔の開度はコロナチンの濃度が高まるにつれ増大し、 10^{-6} M で最大に達した。またコロナチンによる気孔の開口は、処理1時間後に認められた。イタリアンライグラスの場合にも、コロナチン処理により著しい気孔の開口が認められた。

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