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Phytochemistry, Vol 26, No. 3, pp. 877–878, 1987
Printed in Great Britain

0031-9422/87 $3.00 + 0.00
Pergamon Journals Ltd.

TOMATINE, ITS EFFECT, AND INTERACTION WITH ABSCISIC ACID ON STOMATAL OPENING IN *COMMELINA COMMUNIS*

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(*Revised received* 6 *March* 1986)

Key Word Index *Commelina communis*; Solanaceae; stomata; tomatine; abscisic acid.

Abstract -Tomatine, a glycoalkaloid, induces stomatal closure in epidermal peels of *Commelina communis*. It is more potent than abscisic acid (ABA) and reverses ABA-induced stomatal closure.

INTRODUCTION

Tomatine, a glycoalkaloid found mainly in the family Solanaceae, has been associated in the past with resistance to wilt caused by the fungus *Fusarium oxysporum* f. *lycopersici* [1–3]; however, its mode of action is not clear. Now we show that tomatine causes stomatal closure and is more potent than even abscisic acid, an established inhibitor of stomatal opening [4]. Thus, the tomatine associated resistance to wilt could be at the level of regulation of stomatal opening or at least partially. Recently, we demonstrated that ABA-induced stomatal closure can be reversed by a number of phenolic compounds [5]. Now we report that tomatine can also reverse ABA-induced stomatal closure. Our observations and the localization of phenolic compounds in the stomatal apparatus [6] suggest some regulatory role of secondary metabolites in stomatal mechanisms and, hence, in the process of transpiration.

RESULTS AND DISCUSSION

Both tomatine and ABA caused stomatal closure in *Commelina communis* and tomatine proved to be more potent than ABA (Fig. 1A). At 10^{-4} M, ABA caused 40% closure, while with tomatine at the same concentration the closure of stomata was total. However, a definite antagonism was noticed when ABA (10^{-4} M) and tomatine at lower concentrations (10^{-7} and 10^{-6} M) were applied together; at higher concentrations of tomatine the inhibition persisted (Fig. 1B). A similar reversal of ABA-induced stomatal closure by phenolic compounds, another group of secondary metabolites, has recently been shown by us [5]. Thus, our results show a new effect of glycoalkaloids on stomatal opening.

The mode of action of tomatine in this context is unknown. However, tomatine at neutral pH is highly membranolytic and forms a complex with cholesterol [7] as well as increasing the permeability of beet root membranes to betacyanin [8]. Thus, tomatine-induced stomatal closure is probably related to the changed permeability of guard cell membranes to K^+ or other ions. ABA also acts by directly affecting the ionic and metabolic status of guard cells [9] and binding to guard cell membranes [10].

EXPERIMENTAL

Plants of *C. communis* L. growing in their natural habitat (Shimla, W. Himalayas, *ca* 2300 m) during the rainy season were used. Abaxial epidermis peeled from fully expanded leaves closest to the apex was used. Solns of tomatine and ABA (Sigma) were prepd in 0.1 M NaPi buffer (pH 7). Epidermal strips, equilibrated in buffer soln for 1 hr, were incubated for 3 hr in buffer or buffered solns in glass Petri dishes under fluorescent light (3.4 W m^{-2}). Stomatal opening was measured using a calibrated eye piece graticule for 30 randomly located stomata as described earlier [5]. Expts were repeated twice.

Acknowledgements This work was supported by the Department of the Environment, New Delhi.

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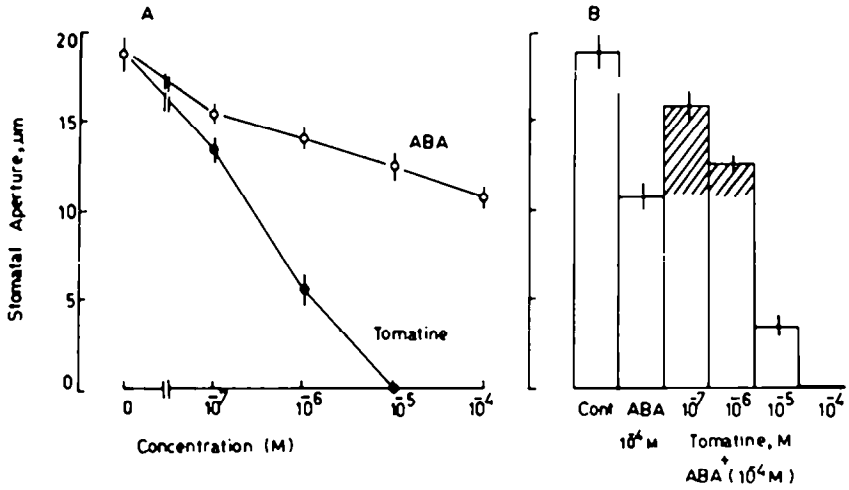

Fig. 1A. Stomatal closure by tomatine and ABA in *Commelina communis* epidermal peels in light after 3 hr. B. Interaction between ABA and tomatine on stomatal opening in *Commelina communis* epidermal peels. Shading represents the recovery from ABA-induced inhibition by lower concentrations of tomatine. Vertical bars denote s.d.

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