Pergamon

PII: S0031-9422(96)00638-3

Phytochemistry, Vol. 44, No. 6, pp. 977–978, 1997

0031-9422/97 $17.00+0.00

XANTHOXAL: A REVISION OF THE NOMENCLATURE OF THE ABA PRECURSOR XANTHOXIN

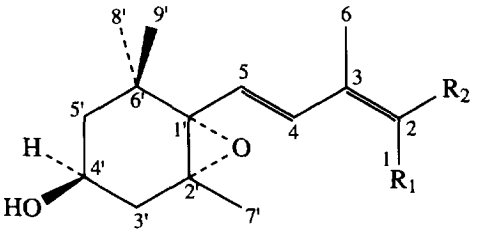
B. V. MILBORROW,* R. S. BURDEN† and H. F. TAYLOR†

* School of Biochemistry and Molecular Genetics, The University of New South Wales, Sydney, New South Wales 2052, Australia

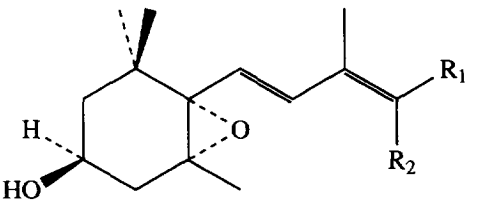
(*Received* 2 *July* 1996)

Xanthoxin was characterized as a photolytic cleavage product of the carotenoid violaxanthin by Taylor and Burden [1]. When formed by light or oxidative cleavage [2], or even by the action of the enzyme lipoxygenase [3], it occurs as a mixture of the 2-*cis*- and 2-*trans*- (**2**) isomers in a ratio of between 1:2 and 1:10. However, only the 2-*cis*- is converted into ABA. Several different investigations have established that xanthoxin occurs naturally [1, 2] and it was shown to be converted into ABA in plants by Taylor and Burden [2] and in cell-free systems. Furthermore, several groups [4, 5, 6] have established that ABA-deficient mutant plants are unable to oxidise an aldehydic group into the carboxylic acid group of ABA. Lee and Milborrow [7] have found that tungstate can replace the molybdate ions of the aldehyde oxidase in an avocado cell-free preparation and labelled xanthoxin then accumulates at the expense of labelled ABA. Thus it appears that the aldehyde group at C-1 of xanthoxin is oxidized to form the carboxylic acid group of xanthoxin acid (**3**).

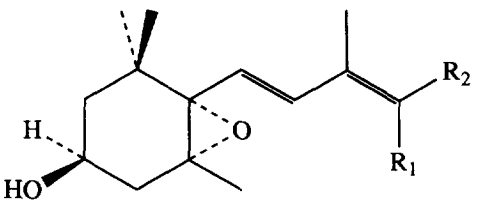
In view of the increasing importance of xanthoxin



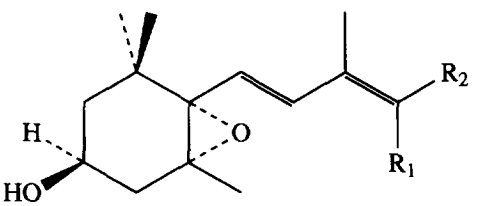
1 R_1 = -CHO, R_2 = H:
xanthoxal = XAN (xanthoxin)
revised ABA numbering



2 R_1 = -CHO, R_2 = H:
2-*trans*-xanthoxal = 2-*t*-XAN



3 R_1 = -COOH, R_2 = H:
xanthoxic acid = XAN-acid



4 R_1 = -CH_2OH, R_2 = H:
xanthoxol = XAN-ol

† Formerly at the ARC Plant Growth Substance and Systemic Fungicide Unit, Wye College (University of London), Ashford, Kent.

in studies of ABA metabolism we considered it was appropriate to redefine the nomenclature. As xanthoxin is an aldehyde we suggest the name 'xanthoxal' (**1**) should be adopted and that the acid be referred to as 'xanthoxic acid' (**3**) and the alcohol as 'xanthoxol' (**4**). Abscisic acid is defined as the 2-*cis*- isomer and so only the 2-*trans*- analogue requires specification, so with xanthoxal: the 2-*trans*- isomer (**2**) only would need to be specified.

The abbreviation 'XAN' has been used frequently and we suggest that it should be retained for the 2-*cis*-isomer (i.e. xanthoxal). The alcohol and acid require an abbreviated definition so XAN-ol and XAN-acid could be the short version of these.

The numbering system of ABA has been completely specified recently [8] and the same numbering can apply to xanthoxal (**1**).

Although the zeaxanthin epoxidase would be expected to be completely stereospecific, some non-enzymic epoxidation may occur *in vivo* as, for example, the β-ring of lutein is readily expoxidised in air. This would give almost half of the epoxy group with the unnatural (U) configuration and some of this could give rise to (U)-xanthoxal.

Natural xanthoxal has the same arrangement of atoms at C-1′ as (+)-S-ABA and application of the Cahn, Ingold, Prelog rules of 1966 [9] gives the absolute configuration of C-1′ as *S* and C-2′ as *R*.

REFERENCES

1. Taylor, H. F. and Burden, R. S., *Proceedings of the Royal Society B*, 1972, **180**, 317–346.
2. Taylor, H. F. and Burden, R. S., *Nature*, 1970, **227**, 302–304.
3. Firn, R. D. and Friend, J., *Planta*, 1972, **203**, 263–266.
4. Leydecker, M.-T., Moureaux, T., Kraepiel, Y., Schnorr, K. and Caboche, M., *Plant Physiology*, 1995, **107**, 1427–1431.
5. Walker-Simmons, M., Kudrna, D. A. and Warner, R. L., *Plant Physiology*, 1989, **90**, 728–733.
6. Sindhu, R. K. and Walton, D. C., *Plant Physiology*, 1988, **88**, 178–182.
7. Lee, H. S. and Milborrow, B. V. (unpublished).
8. Boyer, G. L., Milborrow, B. V., Wareing, P. F. and Zeevaart, J. A. D., in *Plant Growth Substances* 1985, ed. M. Bopp. Springer, Berlin, 1986, pp. 99–100.
9. Cahn, R. S., Ingold, C. and Prelog, V., *Angewandte Chemie, International Edition in English*, 1966, **5**, 385.