Phytochemistry, Vol 27, No 5, pp 1233–1234, 1988
Printed in Great Britain Pergamon Press plc

SYMPOSIUM REPORT

AMINES IN PLANTS

A symposium organised by The Phytochemical Society of Europe held in University College, London, 21–22 December 1987

This meeting, with nearly 100 participants from 13 countries, bore witness to the interest now shown in plant amines, and especially in the ubiquitous group known as the polyamines In many ways the polyamines are still mysterious, despite the efforts of 50 years work. Even so, we are approaching a clearer understanding of their properties, particularly the importance of their involvement in growth and development which is almost certainly mediated by their interaction with nucleic acids and membranes The knowledge that these amines are concerned in growth has led to the development of a range of inhibitors of polyamine biosynthesis for use in human chemotherapy, notably difluoromethylornithine and related compounds, which have proved useful in the control of certain forms cancer. More recently, these have shown promise in the control of trypanosome diseases and *Pneumocystis carinii*, which is one of the complications of AIDS.

The last few years have given an accelerating insight into the functions of the polyamines in plants, which was well illustrated by the research presented in this symposium In some plant systems, exogenous polyamines may stimulate growth or re-direct development, as shown in the talks by Dr S. H Mantell and Prof Y Mizrahi. Indeed, many *in vitro* systems have now been shown to be affected by application of polyamines However, in other systems, exogenous polyamines are relatively inert, and this may be related to mechanisms for their uptake and distribution, problems which were discussed by Prof N Bagni. In some plant systems, treatment with difluoromethylornithine has been shown to inhibit growth, and the effect of this inhibitor was reversed specifically by application of putrescine, providing good evidence that these amines are concerned in growth processes

The demonstration of decarboxylases for both ornithine and arginine in higher plants raises questions about the functions of these two enzymes It has been suggested that ornithine decarboxylase is related to cell division, while arginine decarboxylase is concerned in extension growth and reaction to stress We need more information on these enzymes before we can give firm answers to this. Similarly we have the problem of deciding the reason for the presence of the three amines—putrescine, spermidine and spermine. Does each have its own function?

Inhibitors like DFMO are useful tools in the study of polyamines but these inhibitors are now also of interest as potential fungicides. At a time when many pathogenic fungi are becoming resistant to existing means of chemical control, the development of a new generation of fungicides would be very desirable. The work of Prof. A W. Galston's group at Yale, and of Prof D M. Lewis and Dr J. Bailey at Sheffield, has given a basic understanding of the functions of the polyamines in fungi However, the subject of polyamine metabolism in fungi and other lower plants is still largely uncharted and deserves greater attention. It is now well established that strange amines can occur in bacteria, and Dr J L. Firmin showed that this is certainly true in *Agrobacterium* and *Rhizobium*

Our understanding of polyamine metabolism in higher plants is expanding rapidly and is presenting many opportunities for the chemical manipulation of growth One of the problems which we must still try to solve concerns the apparently restricted distribution of the amine oxidases, and indeed, of other enzymes of polyamine metabolism. It seems difficult to believe that other mechanisms for amine degradation do not occur in higher plants. Dr D J Robins and Dr T. Hartmann both talked about the biosynthesis of alkaloids from amines, a process which very often starts with the oxidation of amines. In addition, Dr Robins gave us dire warnings on the hazards of drinking comfrey tea, now known to contain pyrrolizidine alkaloids!

Other major routes of amine metabolism include the formation of amides with cinnamic acids, and it may be in the form of such conjugates that the amines are further degraded in some plants Dr J. Negrel, and the group working in Dijon, France, have shown that a major part of the polyamines can occur as the amides of hydroxycinnamic acids in tobacco and in other plants Until now, the enzyme forming these amides in tobacco has been very elusive, but Dr Negrel has shown that it is inhibited by the quinones present in the extracts, and that this can be overcome by addition of ascorbate.

Mystery still surrounds the reason for putrescine accumulation in conditions of stress. In my early work with Dr F J Richards, it was shown that putrescine can be accumulated to quite high concentrations in potassium deficient plants, comprising up to 1 2% of the dry matter, or 20% of the total nitrogen. In his talk Prof. G R Stewart listed the diversity of environmental stress factors known to cause putrescine accumulation, now encompassing pH, magnesium deficiency, osmotic shock, cold injury, sulphur dioxide pollution and cadmium and ammonium toxicity We must soon address the question "Is there a common process associated with these stress factors for which putrescine accumulation is beneficial to the plant"?

We should not lose sight of the fact that this Symposium was entitled 'Amines in Plants' and that the polyamines are not the sole representatives of this group in plants. Professor J. D. Phillipson told us of the importance of various amines in pharmacology, and of the hazards of some naturally occurring phenolic amines in our food, and Dr J Negrel showed how tyramine can

also be found as conjugates with cinnamic acids, which can then be readily incorporated into lignin. The 36 posters presented at the meeting covered the amine field in the broadest sense, with topics ranging from poly- and phenolic-amines to alkaloids, amino acids and betaines

Although the role of many of the amines in plants remains unclear, the last few years has seen a rapid expansion of our knowledge, particularly concerning the polyamines, and it should not be long before we can attempt to exploit this knowledge in our agricultural practices

TERENCE A SMITH

Research Station
Long Ashton
Bristol BS18 9AF *U K*

THE NORTH AMERICAN TANNIN CONFERENCE

August 9–11, 1988
Port Angeles, Washington, U S A.

The first North American Tannin Conference will be held August 9–11, 1988 in Port Angeles, Washington. Invited speakers will present 26 critical reviews covering the chemistry, biogenesis, structure, analytical methods, toxicology, biological significance, and use of tannins as specialty chemicals. Dr Herbert L Hergert will be honored as the first recipient of the Tannin Conference Award for his pioneering contributions to the chemistry and use of condensed tannins The conference is open to general attendance A fee will be charged

The conference is jointly sponsored by Oregon State University, Corvallis, Oregon and the USDA Forest Service, Southern Forest Experiment Station, Pineville, Louisiana.