RESEARCH POTENTIAL OF WETLAND PLANTS

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Wetland areas have received considerable public attention over the last year or so and a case for research and conservation has been built on three main assumptions. They are that wetlands play an important role in marine productivity, provision of fish and bird habitats and in land stabilisation. A fourth consideration might be the intrinsic nature of the fauna and flora that inhabit such areas. The flora of wetland areas frequently have to survive tidal inundations with the accompanying problems of anoxia and elevated salinity. It is generally agreed that wetland flora have undergone selective change or 'adaptation' but how this has happened is difficult to determine. The enigma of how wetland plants persist, let alone grow, and reproduce in such apparently hostile conditions remains unsolved. No doubt, the answers lie in the study of the morphology, physiology and ecology of the various species. However, of increasing interest is whether such plants contain discrete units of genetic information relating to these characteristics that may be of vital interest in the genetic engineering of more economically important crop plants.

The past year has at long last seen the successful genetic modification of plants by the insertion of DNA from the test-tube. Success has come, albeit in a very limited number of species, by exploiting the components of the natural DNA transfer system of a soil bacterium. The genetic engineers have essentially introduced new genes into a plant cell by infecting it with a specially modified form of the bacterium. It is now practical to recover perfectly normal plants containing an introduced gene and have it normally propagated. The limitation of this approach is fast becoming the availability of economically important genes to be manipulated by such techniques.

Basic research on wetland plants should be pursued in the hope that a better understanding of survival mechanisms such as salt and flood tolerance will emerge. As plant production depends on CO_2 uptake in mature leaves, and since this is inevitably associated with transpiration and salt transport, the retranslocation of salt from the leaf is seen as an important area for research. This, and the integration of salt effects on photosynthetic physiology and water relations in the leaves may be central to the physiological complex conferring salinity tolerance on plants. Above all else angiospermous halophytes are distinguished from glycophytes by their ability to accumulate ions to high concentration in the leaf cells and to localise such ions outside the cytoplasm. There is little evidence of metabolic adaptation to high levels of salt and this lack of accommodation correlates with the widespread occurrence of salt tolerance, not only in bacteria, fungi and algae but also among the various orders of higher plants. Such a widespread occurrence of salt tolerance may indicate relatively few genetic differences between salt-tolerant and salt-sensitive plant species. However, nothing is known of the nature of the genetic differences that may confer the property of salt tolerance in wetland plants. Indeed, it is likely that several different mechanisms for salt tolerance exist. It is exciting to speculate that further research will reveal whether the properties conferring salinity tolerance at the cellular level are sufficient alone to confer improved salt tolerance in plants. Tolerance at the cell level presumably involves cell membrane properties and the synthesis of protective organic substances in the cytoplasm. Variations in these properties between cells in different tissues, and between cells in the same tissue of different plants may also determine higher order interactions underlying differences in salinity tolerance.

Wetland plants are by definition flood tolerant and the roots of such plants are often permanently waterlogged and thus potentially subject to low oxygen tensions. Some plants such as the mangroves have evolved aerial roots as a survival strategy but others may have adapted metabolically to low oxygen tension in the tissues. The response of a plant species to flooding may depend therefore on its metabolic adaptations rather than its efficiency in translocating oxygen from one part of the plant to another. Much argument still rages on the nature of the mechanism of flood tolerance in plants and again nothing is known of the genetic characteristics of flood tolerance.

Perhaps with further research on the nature of salt and flood tolerance in wetland plants the transfer of these survival properties to more sensitive crop plants will become a reality. The challenge is an exciting one and another good reason to study and conserve our diminishing wetlands.