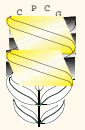


Genetic Diversity and Distribution of Australian Wild Rice *Potamophila parviflora*



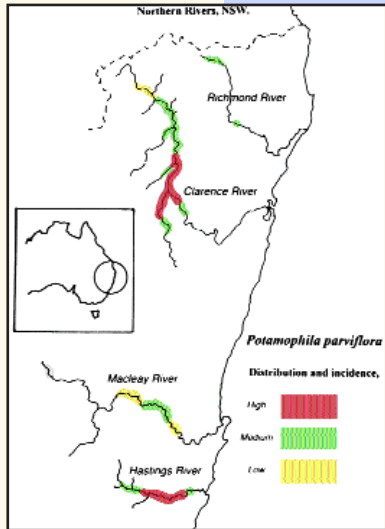
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Introduction

Rice is one of the world's major food crop which has been cultivated for more than 7000 years. Rice belongs to tribe *Oryzae* which includes 12 genera and about 70 species, most of which have not been the subject of detailed molecular genetic studies. The wild relatives of cultivated rice are important sources of useful genes for genetic improvement of rice production and quality. We have investigated species from 2 genera, *Zizania* from North America and *Potamophila* from Australia, and related them to *Oryza*. *Zizania* is a native North American plant that grows in the eastern and east central parts

of that continent. *Zizania palustris* L is an edible species which is now cultivated (Oelke et al., 1997). *Potamophila parviflora* R.Br. which is the only species in this genus is endemic to the rivers of New South Wales. We have traced wild populations of this species and initiated a program of collection of germplasm and analysis of genetic diversity and relationships. The nucleotide sequences of the first internal transcribed spacer (ITS 1), between the 17S and 5.8S ribosomal DNA genes of these wild rices have been used to determine genetic relationships.



Characteristics and distribution of wild rice varieties of *Potamophila* and *Zizania*

Potamophila parviflora is a large clumped semiaquatic grass of Australia which grows mainly in the northern rivers of NSW. The map shows the collecting locations, distribution and abundance of *Potamophila parviflora* in and around the creeks and rivers of northern NSW. Samples of this plant were found in the Richmond, Clarence, Macleay, Manning, and Hastings River systems. Peak incidence of *P. parviflora* was found along the southern bank of the Manning River, a tributary of the Clarence river. Clumps in excess of 2m in diameter and 1.8m high were frequently found in this location. The mid Clarence River is also densely populated. The most northern

incidence of *P. parviflora* located was Eden Creek, a tributary of the Richmond River. At this site the plants were present at a low density with clumps 0.5 m in diameter and a meter high.

The coldest location which *P. parviflora* was found was above Dangars Falls on the upper reaches of the Macleay River, 23 km south east of Armidale. Temperatures in this area reach minus six degrees on some winter nights. Plants in this location were small and scattered with clump diameter no more than 0.4m across and 0.6m high. Leaf and seed samples of this plant collected from various sites have been stored to be used for further analysis.



Australian rice cultivar Jarrah



Potamophila parviflora, Upper Eden Creek



North American wild rice, *Zizania*

The Tribe Oryzae (Poaceae)

Genus	Number of Species	Distribution	Chromosome Number (2n)
<i>Oryza</i>	22	Pantropical	24
<i>Zizania</i>	3(4)	North America Asia, Europe	30,34
<i>Potamophila</i>	1	Australia	24
<i>Prospodychloa</i>	1	Southern Africa	Unknown
<i>Maltebrunia</i>	5	Tropical and South Africa	Unknown
<i>Leersia</i>	17	Worldwide	24,48,60,96
<i>Zizaniopsis</i>	5	North and South America	24
<i>Porteresia</i>	1	South Asia	48
<i>Luziola</i>	11	North and South America	24
<i>Rhynchoriza</i>	1	South America	24
<i>Hygroryza</i>	1	Asia	24
<i>Chikusochloa</i>	3	China, Japan	24

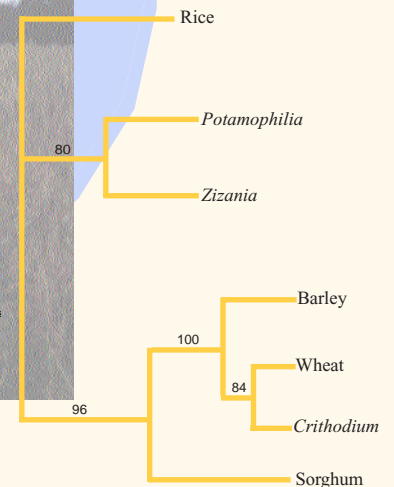
Genetic Analysis

Total DNA was extracted from the leaf samples of each individual wild rice plant and used for PCR amplification and direct PCR sequencing. The ITS was amplified using primers which were designed from conserved regions of 17S and 5.8S ribosomal genes based on the published sequence of rice DNA (Takaiwa, 1985).

Resulting sequences together with published ITS 1 region sequences of rice, *Oryza sativa* (Takaiwa et al. 1985), and sequences of four other grasses from the tribe Triticeae (Hsiao et al. 1994) were used as the input data in phylogeny analyses. These sequences were aligned using the CLUSTAL V computer programs. Phylogenetic analyses of ITS1 were carried out in PAUP 3.1.1 using the exhaustive search option.

different habitat, a close relationship exists between the North American wild rice, *Zizania* and the Australian wild rice *Potamophila*. The ITS1 sequence data also provide evidence that *Potamophila* is more closely related to rice and potentially a better source of useful gene for the improvement of cultivated rice.

The ability of *Potamophila* to grow at low temperatures may have a particular significance and relevance to our search for cold tolerance genes from wild rice to transfer to the commercially grown Australian rice varieties.



Phylogenetic tree derived from ITS1 sequence analysis

Conclusion

Molecular evidence concerning the phylogeny of rice and related taxa were obtained by comparing sequences from the first internal transcribed spacers (ITS1) of nuclear ribosomal RNA genes. Phylogenetic trees of these species generated from the ITS1 sequence data were in general agreement with phylogenies based on the traditional taxonomic classification by Clayton and Renvoize (1986). This study confirmed that sequences of the ITS region are useful for phylogenetic studies among closely related species. Within the *Oryzae* clad, our data suggest that, despite a widely

Clayton, W.D., & S.A. Renvoize, 1986. Genera Graminum, grasses of the World. Kew Bulletin Addition series XIII H. M. Stationery Office, London.

Hsiao, C., N.J. Chatterton, K.H. Asay, & K.B. Jensen, 1994. Phylogenetic relationships of 10 grass species: an assessment of phylogenetic utility of the internal transcribe spacer region in nuclear ribosomal DNA in monocots. *Genome* 37: 112-120.

Oelke, E.A., R.A. Porter, A.W., Grombacher, & P.B. Addis, 1997. Wild rice-New interest in an old crop. *Cereal Foods World* 42: 234-247.

Takaiwa, F., K. Oono, M. Sugiura, 1985. Nucleotide sequence of the 17-25 region from rice rDNA. *Plant Molecular Biology* 4: 355-364.