Transposable element distribution, abundance and role in genome size variation in the genus Oryza

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Zuccolo A, Sebastian A, Talag J, Yu Y, Kim H, Collura K, Kudrna D, Wing RA.

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Abstract

BACKGROUND:

The genus Oryza is composed of 10 distinct genome types, 6 diploid and 4 polyploid, and includes the world's most important food crop - rice (Oryza sativa [AA]). Genome size variation in the Oryza is more than 3-fold and ranges from 357 Mbp in Oryza glaberrima [AA] to 1283 Mbp in the polyploid Oryza ridleyi [HHJJ]. Because repetitive elements are known to play a significant role in genome size variation, we constructed random sheared small insert genomic libraries from 12 representative Oryza species and conducted a comprehensive study of the repetitive element composition, distribution and phylogeny in this genus. Particular attention was paid to the role played by the most important classes of transposable elements (Long Terminal Repeats Retrotransposons, Long interspersed Nuclear Elements, helitrons, DNA transposable elements) in shaping these genomes and in their contributing to genome size variation.

RESULTS:

We identified the elements primarily responsible for the most strikingly genome size variation in Oryza. We demonstrated how Long Terminal Repeat retrotransposons belonging to the same families have proliferated to very different extents in various species. We also showed that the pool of Long Terminal Repeat Retrotransposons is substantially conserved and ubiquitous throughout the Oryza and so its origin is ancient and its existence predates the speciation events that originated the genus. Finally we described the peculiar behavior of repeats in the species Oryza coarctata [HHKK] whose placement in the Oryza genus is controversial.

CONCLUSION:

Long Terminal Repeat retrotransposons are the major component of the Oryza genomes analyzed and, along with polyploidization, are the most important contributors to the genome size variation across the Oryza genus. Two families of Ty3-gypsy elements (RIRE2 and Atlantys) account for a significant portion of the genome size variations present in the Oryza genus.