

## Smaller model genome for monocots – *Brachypodium distachyon*

A model organism means a biological species which is extensively studied to understand a particular biological process. There has been tremendous advancement in the past 20 years in the field of genomics and the quest for searching appropriate model organisms to aid studies which are of significant commercial or biological interest. A field of genomics known as ‘functional genomics’ has created challenges for model organisms in understanding the function of every gene in the genome<sup>1</sup>. A model organism is chosen on the basis of certain criteria which include characters like short life-cycle, low proportion of junk DNA, acquiescent to experimental manipulation, non-specific living requirements, cheap to maintain and possessing characteristics of industrial, medical or agricultural interest.

Many multinational companies are investing money on sequencing crops like rice; the question arises whether investment on a new crop makes sense. No doubt, rice has been a plant of concern as a potential crop for biotechnology and has helped in our understanding of crop improvement for the past several years<sup>2</sup>. The answer can be acceptable with argument in favour of a model needed for cool-season grass crops. Fifty million years of evolution has separated rice from cool-season crops, which is easily depicted in morphology, physiology, phenology and biotic and abiotic stress tolerance and susceptibility<sup>3</sup>. These characters have restricted the selection of rice as a model system for cool-season grasses (temperate cereals).

*Brachypodium distachyon*, commonly called ‘purple false brome’, is a grass

locally found in southern Europe, northern Africa and southwestern Asia. It belongs to the family Poaceae and is closely related to Triticeae. *B. distachyon* has several features for selection as a model system for genomics of monocots. It has a small genome compared to rice (approx. 350 bp), annual lifecycle, self-fertile, easily transformable, has simple growth requirements and exhibits a close relationship with the temperate cereals or cool-season grasses, turf and forage species in the family<sup>4</sup>. The small genome of *B. distachyon* with diploid ecotypes ( $2n = 10$ ) makes it useful for genome sequencing<sup>5</sup>. Its small lifecycle provides an advantage, as it takes about three weeks for flowering. This weed can be grown without any specific requirements. *B. distachyon* has genes thought to synthesize lignin precursor essential for bio-fuel production<sup>6</sup>.

The International *Brachypodium* Initiative (IBI) has the goal to promote *B. distachyon* as a model system<sup>7</sup>. It held its first workshop and meeting at the PAG XIV Conference in San Diego, California in January 2006. The IBI will develop and distribute genotypes, genetic and bioinformatics resources, genetic markers and genome sequencing database to help researchers already working with *B. distachyon*. With more comparative genomics being done, there is going to be a drift and shift from rice to *B. distachyon* genomics. Presently, studies with *B. distachyon* are focusing on *Agrobacterium*-mediated transformation and inbred line development, cytotoxicity, mutagenesis, analysis of genetic variations, genome composition, gene content and organization, and establishing phylo-

genetic relationships with other grasses<sup>8,9</sup>. There is incredible amount of information coming these days, as sequencing a genome is becoming cheaper<sup>10</sup>. In the days to come, scientists and those associated with genomics of plants will accept *B. distachyon* as a new model system for monocots.

1. Botstein, D. and Cherry, J. M., *Proc. Natl. Acad. Sci. USA*, 1997, **94**, 5506–5507.
2. Sasaki, T., *Curr. Sci.*, 2002, **83**, 834–839.
3. Hasterok, R., Draper, J. and Jenkins, G., *Chromosome Res.*, 2004, **12**, 397–403.
4. Draper, J., Mur, L. A., Jenkins, G., Ghosh-Biswas, G. C., Bablak, P., Hasterok, R. and Routledge, A. P. M., *Plant Physiol.*, 2001, **127**, 1539–1555.
5. Garvin, D. F., In *Model Plants and Crop Improvement* (eds Varshney, R. K. and Koebner, R. M. D.), CRC Press, Boca Raton, 2007, pp. 109–123.
6. Vogel, J. P. et al., *Theor. Appl. Genet.*, 2006, **113**, 186–195.
7. [http://www.brachypodium.org/IBI/International\\_Brachypodium\\_Initiative.html](http://www.brachypodium.org/IBI/International_Brachypodium_Initiative.html)
8. <http://brachypodium.pw.usda.gov/>
9. Hasterok, R. et al., *Genetics*, 2006, **173**, 349–362.
10. Wolinsky, H., *EMBO Rep.*, 2007, **8**, 900–903.

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## Naming angiosperm fossils from Miocene and younger rocks

Angiosperm fossils reported from the Miocene and younger horizons are often strikingly similar in morphology to modern forms. Most of these fossils have been assigned to modern genera but seldom to modern species because of the general perception that the use of names of modern species for fossil plant organs

could lead to misinterpretation of their taxonomy and systematic position. Hence new species epithets have been coined to name these fossils. However, the possibility that recognition of a fossil organ as a new morphospecies under a modern genus may not be unequivocal also deserves attention<sup>1</sup> because even if

the fossil organ, particularly if it is a leaf or wood, may resemble some living form, the group to which it belongs may not have acquired features critical for the identification of the modern compared genus<sup>2</sup>. It has therefore been recommended that fossils may be assigned to a modern genus only if the diagnostic

range of characters falls within the range of variation in that particular genus<sup>3</sup>.

It has also been noticed that many a time due care has not been taken while coining species epithets for these fossils; for example, *Amoora palaeowallichii* (resembles extant *Amoora wallichii*, Meliaceae), *Hydnocarpus palaeokurzii* (resembles extant *H. kurzii*, Flacourtiaceae), *Macarangaephyllum palaeomonadrum* (modern compared taxon *Macaranga monadra*, Euphorbiaceae), *Malottophyllum palaeomiquelianum* (compared with extant *Malottus miquelianum*, Euphorbiaceae), *Milletia miobrandisiana* (resembles extant *M. brandisiana*, Fabaceae), *Randia miowallichii* (resembles extant *R. wallichii*, Rubiaceae), *Swin-tonia palaeoschwenckii* (resembles extant *S. schwenckii*, Anacardiaceae), etc. The extant species obviously are named in honour of certain persons; for example, Wallich, Kurz, Miquel, Brandis and Schwenck, but can one derive the names for fossil morphospecies, which appar-

ently resemble extant species, by prefixing personal name-based species epithets of the latter with 'palaeo-' or 'mio-'? Obviously not! One does not expect the existence of Palaeocene ( $65.5 \pm 0.3$ – $55.8 \pm 0.2$  m.y. BP) or Miocene ( $23.03$ – $5.33$  m.y. BP) clones or namesakes of these dignitaries. Further, the prefix 'palaeo' is derived from Greek *παλαιός* (*palaios*), which means old(er), and the prefix 'mio' is derived from Greek *μείων* (*meioon*), which means less. So combining these Greek epithets with personal names makes little sense. Such species epithets, and many others like, *palaeohirsutum* (old hairy?), *palaeoreticulatum*, *palaeoalba* (= old white?) or *preaureum* (= before golden?) for fossil morphospecies could have been better avoided, though not specifically forbidden under provisions of the International Code of Botanical Nomenclature<sup>4</sup> [Article 23.2. 'The epithet in the name of a species may be taken from any source whatsoever, and may even be composed arbi-

trarily', but Recommendation 23A.1 states 'Names of persons and also of countries and localities used in specific epithets should take the form of nouns in the genitive (*clusii*, *porcildiorum*, *saharae*) or of adjectives (*clusianus*, *dahuricus*)'].

1. Ferguson, D. K., *Bot. J. Linn. Soc.*, 1974, **68**, 51–72.
2. Cronquist, A., *The Evolution and Classification of Flowering Plants*, New York Botanical Garden, 1988, 2nd edn.
3. Collinson, M. E., *Syst. Assoc. Spec. Vol.*, 1986, **31**, 91–104.
4. McNeill, J. *et al.*, International Code of Botanical Nomenclature, A.R.G. Gantner Verlag KG, 2006.

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## Non-persistent mudbanks off Kerala coast

The mudbanks found along Kerala coast can be classified into persistent and non-persistent types based on their activity and sustenance. The persistent mudbanks occurring off Alleppey coast are active during monsoon and are sustained throughout the year with decreasing intensity. These are formed due to the presence of zaheerite in the muddy sediments present in shallow waters<sup>1</sup>, together with other physical conditions such as bathymetry, waves and sediments which favour their formation. On the contrary, mudbanks formed at several places such as Narakkal, Chetuwa and Quilandi during the monsoon period disappear after a short span of time. These are called non-persistent mudbanks, which are characterized by their non-periodicity and inconsistency. Their recurrence in the same area sometimes takes several years.

In order to understand the nature of formation of non-persistent mudbanks, six marine surface-sediment samples were collected during pre-monsoon, five south off Narakkal and one off Chetuwa. XRD results of all the samples have shown montmorillonite as the major clay mineral with minor amount of kaolinite,

gibbsite and quartz. The striking feature of this study is the omnipresence of gibbsite both in persistent and non-persistent mudbanks<sup>1</sup>.

Like zaheerite, gibbsite ( $\text{Al}(\text{OH})_3$ ) is also bipolar with a positive aluminium end and a negative hydroxyl end. When gibbsite is present in the sediments, the negatively charged clay minerals get attracted towards its positive end, than towards the less active univalent sodium and potassium ions or the bivalent magnesium or calcium ions available in sea water. This clustering of clay minerals around gibbsite leads to their flocculation, resulting in quick settling. The individual clusters, due to its irregular shape, cannot come closer and the sediments remain loosely packed. This enables them to carry a large quantity of pore water. Hence, the volume of mudbank sediments is much higher than that of the adjoining sediments. This increase in volume is responsible for the mudbank area to stand out as an elevated wedge-shaped platform above the seafloor<sup>2</sup>.

While logging a vibro-core sample collected south off Narakkal, slurry-type sediments embedded between moderately

compact silty-clay were observed between core depths 150–158 cm and 163–170 cm. These zones have water content of 260% and 210% respectively, which is a rare feature at such depths. These samples were studied using XRD to identify, the various mineral phases present. The results have shown the minor presence of both gibbsite and gypsum in the zone between 150 and 158 cm, and gibbsite between 163 and 170 cm, other than montmorillonite, kaolinite and quartz. In order to understand the role of gibbsite and gypsum in the formation of mudbanks, experiments were conducted using settling jars, with two sets of clay sediments of equal weight collected from a non-mudbank area. About 5% gibbsite–gypsum powder was added to one set of the above sediments. The results show that the volume of the samples with gibbsite–gypsum mixture was about 25% more than the samples without these two minerals.

The present study suggests that non-persistent mudbanks are formed due to the presence of gibbsite which is further facilitated by the presence of gypsum, whereas persistent mudbanks are formed