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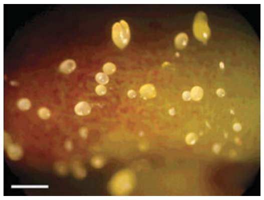
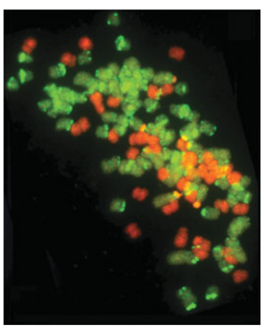
John Bryant takes a closer look at some of this month's Original Articles



Embryos abound with added auxin

The plasticity of plant development is a well-known phenomenon that has extensive use in non-sexual propagation of plants. One widely used method is the induction of somatic embryos, which go on to develop as if they were normal zygotic embryos. The starting material for somatic embryos may be undifferentiated callus, but there are examples where somatic embryogenesis is induced in cells or groups of cells from within a plant. This is illustrated by the work of **Kim *et al.* (Chunchon and Chungju, Korea, pp. 177–183)** on a large deciduous tree, *Tilia amurensis*. Earlier work (Kärkönen, 2000, *Plant, Cell, Tissue and Organ Culture* **61**: 205–214) had shown that somatic embryos arise from the surface of the cotyledons of zygotic embryos under certain culture conditions. The authors have now extended these observations and determined exactly which cells it is that express this embryogenic potential. Embryos were dissected from mature seeds and set-out to germinate on a hormone-free culture medium *in vitro*. Soon after germination, the seedlings produced both hairy and glandular trichomes, especially on hypocotyls and cotyledons. If the growth medium was supplemented with the synthetic auxin 2,4-D, formation of hairy trichomes was suppressed but formation of glandular trichomes was increased. Further, at the optimum concentration of 2,4-D, approx. 45 % of the glandular trichome initials (at the early filamentous stage) gave rise not to trichomes but to somatic embryos. This resulted in an almost bizarre situation in which the cotyledonary surface became coated in a 'forest' of embryos. Despite the general plasticity of plant development, this is a very unusual occurrence, indicating that cells committed to a particular developmental pathway within the young plant still retained an embryogenic potential that is readily elicited with 2,4-D. It is a fascinating system with which to study plant development and likely to be very useful in rapid propagation, particularly of *T. amurensis* genotypes.



Probing plant parentage proves previous postulate

In my walks alongside the estuary of the River Exe near my home, a small stand of *Spartina anglica* reminds me of the importance of allopolyploidy in plant speciation and evolution. This involves hybridization followed by genome duplication that restores the ability of chromosomes to pair at meiosis. With *S. anglica* the parenthood is well known. However, for many species allopolyploidy has had to be deduced from chromosome numbers and overall plant characteristics. An example of this is *Iris versicolor* which, with its chromosome number $2n = 108$, has been regarded as an allopolyploid derived from hybrids between *I. virginica* ($2n = 70$) and *I. setosa* ($2n = 38$). This idea about the parental origins of *I. versicolor* has now been beautifully confirmed by **Lim *et al.*, from London, UK and Brno, Czech Republic* (pp. 219–224)**. The authors made fluorescent probes for the whole genomes of both species (for GISH: genomic *in situ* hybridization) and for specific ribosomal RNA genes (for FISH: fluorescent *in situ* hybridization). GISH clearly showed that chromosome sets from both the putative parents were present in *I. versicolor*, thus confirming the long-held hypothesis on the parentage of this species. However, FISH showed some uniparental loss of specific genes. The 26S and 18S ribosomal RNAs are transcribed from a gene that is repeated many times within the plant genome. In *Iris versicolor*, only the 26S–18S rRNA genes from *I. virginica* are present; those from *I. setosa* having been lost during evolution of the hybrid. By contrast, the repeated genes encoding 5S rRNA from both parents are present, but there has been a partial loss of these genes when derived from *I. setosa*. The loss of rRNA genes derived from one parent, although by no means universal, has been shown in other allopolyploids and may occur following epigenetic silencing, for example because of uniparental imprinting.

* A most appropriate location for studying plant genetics, following the example of Gregor Mendel.

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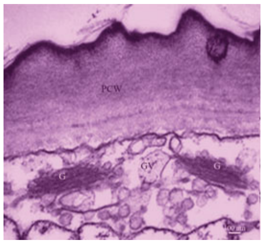
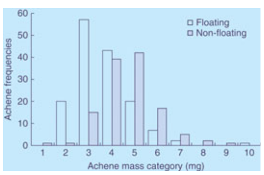


Mutant says '*ello*' to sucrose

The shape and size of plant organs is dependent on cell division and growth, on the polarity of division and growth, and on cell differentiation. These processes are partially regulated by hormones and other growth factors and may also be modified by environmental and nutritional signals. All this is very well illustrated by the work of **Falcone *et al.* (Calabria, Spain; Ghent, Belgium and Adelaide, Australia, pp. 261–220)** working with the *elo1* mutant of *Arabidopsis thaliana*. The mutation itself affects the activity of the histone acetyl transferase Elongator complex; the most obvious feature of the phenotype being narrow leaves caused by a reduction in palisade cell number and a change in the pattern of their expansion. Further, as now shown by the authors, there are sub-cellular changes including less-stacked grana and (under control conditions) many more starch grains in the chloroplasts, a hypotonic vacuole, more plamodesmata, larger Golgi bodies with more active exocytosis and a larger primary cell wall. The authors also studied the interaction between the expression of the mutant phenotype and the metabolism of sucrose, which is both a metabolite and a signalling molecule. There is a clear connection between the *elo1* mutation and sucrose availability. This is partly shown by the effects of the mutation on the expression of genes involved in sucrose synthesis and transport. This was also seen when the effects of adding sucrose were studied. For example, addition of sucrose to the growth medium stimulated the germination of mutant but not of wild-type seeds. By contrast, leaf cell expansion was inhibited by sucrose in the mutants but stimulated in the wild-type. These results and others presented by the authors in this intriguing paper lead to very interesting suggestion that the *elo1* mutation has a major effect on sucrose sensing which, in turn, perturbates the regulation of cell division and cell growth.



Sinkers and floaters – vive la difference

There are several well-known ecological and physiological features that we might list in connection with a plant's ability to become a successful invader. However, it is doubtful whether seed buoyancy would be included in our lists if we were considering terrestrial plants. Such blinkered thinking is challenged by the work of **Fumanal *et al.*, Dijon, France (pp. 305–313)**, which suggests strongly that this feature contributes much to the success of *Ambrosia artemisiifolia* as an invader in France. This ruderal species arrived in Europe from the USA about 100 years ago but is still extending its range. For ruderal species, the ability to reach and to establish quickly on disturbed land is likely to be important and for this reason the authors have focussed on achenes, the main units of dispersal. They found achene mass to vary two-fold; further, many of the lighter achenes were also buoyant and remained afloat in agitated water. Although most of these floating achenes had sunk after about 24 hours, achenes from one population remained afloat for up to 90 hours. However, buoyancy for only a few hours is long enough for the achenes to float considerable distances in flowing water, thereby enhancing the probability of 'landfall' on an exposed bank. Other features associated with buoyancy included deeper dormancy than in non-floating achenes, although after dormancy breakage they germinated faster than non-buoyant achenes (albeit with lower germination percentages). Further, despite their smaller size, buoyant achenes produced taller plants with greater shoot dry mass and higher relative growth rates. This variability in seed mass, dormancy, germinability and subsequent plant growth helps explain the propensity for *A. artemisiifolia* to colonize a range of disturbed habitats, with the ability to float (hydrochory) facilitating long-distance dispersal via rivers such as the Dordogne, Loire and Rhône.

Professor J. A. Bryant
University of Exeter, UK
E-mail j.a.bryant@exeter.ac.uk