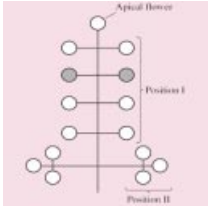


# ContentSelect

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

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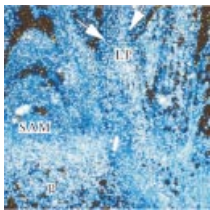


## Puzzles about pistils, pollen and productivity

Olive (*Olea europaea*) is among those species that produce both hermaphrodite and single-sex flowers on the same plant. In *O. europaea*, the single-sex flowers are male and thus the species is described as andromonoecious. Olive trees are wind-pollinated and to some extent self-fertile, but previous research has suggested that more efficient fertilization is achieved by cross-pollination. What, then, are the roles of the two different flower types in pollen production? This question is at the heart of the research carried out by **Cuevas and Polito (Almeria, Spain and Davis, California, pp. 547–553)**.

Staminate (male-only) flowers arise by abortion of pistil development in flowers that start as hermaphrodites. There is earlier research indicating that staminate flowers are much more frequent when nitrogen nutrition is limiting; suggesting that this pattern of floral development may be a means of diverting resources (especially under stress) to pollen formation. This is especially important in wind-pollinated plants. However, the authors' results indicate a more complex situation. Hermaphrodite and staminate flowers were compared in terms of time taken to anthesis, pollen production, pollen germinability and pollen potency. In none of these aspects were there any differences between the two types of flowers. Indeed, the only obvious difference in terms of pollen production was that the staminate flowers tended to open later than hermaphrodite flowers. This was based on the position within the flower panicle: apical flowers and flowers in primary pedicels were mostly hermaphrodite, whereas flowers in secondary pedicels were mostly staminate. But overall, at the level of the individual flower, the abortion of the pistils did not lead to a diversion of resources into pollen production. However, at the whole-plant level the occurrence of staminate flowers increased the ratio of male to female gametes at a later stage of floral development. This, the authors suggest, may be a way of enhancing male fitness.

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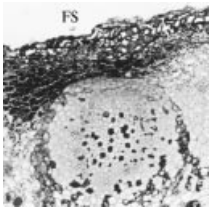
## Cycling prohibited or cycling permitted?

The cell division cycle is controlled at several levels. Within cycling cells there is a complex network of regulatory mechanisms that link the cell cycle phases together. At higher levels there are mechanisms that determine the location and timing of cell division in plant development, for example in the generation of new organs through the activity of meristems. At both levels there are positive and negative regulators, sometimes acting in direct opposition to each other. To add to this complexity there are situations where multiple proteins appear to have the same function. Examples of these are the

'Kip-related proteins' (KRPs) studied in *Arabidopsis thaliana* by **Ormenese et al. (Liège and Gent, pp. 575–580)**. These are generally regarded as negative regulators of the cell cycle because they inhibit the cyclin-dependent kinases that act as positive regulators. The recent discovery of these proteins in plants is not surprising, but what is surprising is the number of KRPs. To obtain information on the possible roles of these KRPs, the authors carried out an exquisitely detailed *in situ* hybridization analysis in the shoot apex, showing clearly that the seven KRPs have different expression patterns. KRPs 1 and 2 are expressed in cells undergoing DNA endoreduplication, KRPs 4 and 5 are expressed in mitotic cells and KRPs 3, 6 and 7 are expressed in a subset of mitotic cells and in cells undergoing endoreduplication. These data clearly suggest that the different KRPs have different roles, but those roles are not entirely clear. Although expression in cells undergoing endoreduplication is consistent with an inhibition of the mitotic cyclin-dependent kinases, it is harder to discern a possible role for those KRPs expressed in cells active in mitotic division. However, it is likely that the possession of several similar proteins with different expression patterns is related to the spatial regulation of cell division in post-embryonic development.

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### Murder in the vineyard

One of the most famous crop losses in recent history was the devastation of French vines by the aphid-like parasite phylloxera (*Daktulosphaira vitifolia*), introduced into France with vines from the USA. The latter are resistant to phylloxera, but in the French vineyards, the parasite encountered a largely susceptible population. The name phylloxera suggests dry leaves, but the above-ground symptoms result from the disruption of root function. Infestation of roots by phylloxera leads to the formation of gall-like structures called nodosities, the formation of which has been investigated by **Alison Kellow and colleagues (Glen Osmond, Australia, pp. 581–590)**. These nodosities form in the root elongation zone indicating that the parasite is able to modify the normal patterns of root growth and differentiation. An interesting feature of this disruption is the failure to form a suberized endodermis in this region of the root, although vascular tissue differentiation appears normal. The nodosities provide an abundant source of nitrogen (via amides and amino acids) and carbon (via sugars derived from starch that accumulates at these sites). That the parasite does indeed use these structures as feeding sources was confirmed by the observation of stylet tracks. After the feeding phase, the nodosities eventually become necrotic, contributing further to the disruption in root function. One key question still to be resolved is why particular vine cultivars are susceptible. The authors report that there is no immediate localized response to the parasite, such as occurs in resistant varieties and, furthermore, there is no induction of the expression of a range of ‘defence genes’. Indeed, the authors suggest that the failure to up-regulate these genes is a direct consequence of the absence of an immediate response. In susceptible cultivars the parasite is somehow ‘invisible’ to the host defence mechanisms and it will be very intriguing to discover how it puts on this ‘cloak of invisibility’.



### Bignons set bait for bats

The phenomenon of bat pollination (chiropterophily), occurring mainly in the tropics, has been known for many years. One example of a bat-pollinated plant is *Adenocalymna dichilum* (Bignoniaceae), a liana of north-eastern Brazil in which the pollination mechanism has only recently been confirmed, as reported by **Machado and Vogel (Recife, Brazil and Vienna, Austria, pp. 609–613)**. These authors have studied in detail the features of the flowers that are associated with chiropterophily. This involved field and laboratory investigation of floral biology and night-time photography of pollinators visiting the flowers. Although this species is classified as a liana, the particular individuals studied by the authors were ‘free-standing’ and approx. 1.5 m tall, a life-form that is adopted in the absence of trees capable of supporting a climbing vine. There is a single inflorescence; at any one time only one or two flowers (which are functional for only one night) are open, but the flowering season goes on for several weeks, giving rise to a ‘steady state’. As is now regarded as typical of bat-pollinated flowers, the corolla is sturdy and the nectary disk is large. In an individual flower, anthesis starts at the end of the day and by the time the bats start feeding, there is copious pollen. Nectar secretion also starts late in the day and the flowers give off a weak but distinct fruity or musky odour. The bats feed on nectar by hovering very close to the flower, inserting their snouts into the flower and using their tongues to reach the nectaries, the whole process lasting less than 1 s. Pollen becomes dusted onto the bats’ necks and shoulders and is transferred to the stigma of the next flower visited. Because each plant only produces one or two flowers at a time, it is very likely that the next flower visited is on another plant, thus favouring out-breeding.

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