

INTRODUCTION TO THE FAMILY ARACEAE

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The family Araceae comprises 105 genera and approximately 3000 species of herbaceous monocotyledons; these are predominantly tropical in distribution, with 90 per cent of genera and about 95 per cent of species restricted to the tropics. The family contains several well-known cultivated foliage and flowering plants, for example *Philodendron*, *Monstera*, *Spathiphyllum* and *Anthurium*. A number of important food crops belong to the Araceae, notably TARO (*Colocasia esculenta*), TANNIA OR COCOYAM (*Xanthosoma sagittifolium*), ELEPHANT YAM (*Amorphophallus paeoniifolius*), KONJAC (*A. konjac*) and GIANT YAM (*Cyrtosperma merkusii*).

There is little contemporary literature on the family, aside from floristic accounts and taxonomic treatments. The best non-technical account is that of Bown (1988). A recent handbook on the aroids of New Guinea (Hay, 1990) and its precursor (Johns & Hay, 1981) provide a good introduction to the aroids as well as being excellent regional accounts. On the genus *Arum*, the classic work is *Lords and Ladies* (Prime, 1960), which is essential reading for anyone wanting to understand the pollination strategy employed by many monoecious aroid taxa.

The family Araceae is defined on the character of the inflorescence: small flowers borne on a fleshy axis (the spadix) subtended by a modified leaf (the spathe). There is much variation on this theme. In some genera the spathe is very conspicuous and brilliantly coloured (e.g. *Lysichiton*, many *Anthurium* species) while in others the spathe is small and leaf-like (e.g. many *Pothos* species). In the genus *Orontium* the spathe is so reduced that it appears to be absent, while in the case of *Gymnostachys*, a peculiar genus restricted to eastern Australia, debate continues as to whether a spathe is in fact present at all. The behaviour of the spathe varies from genus to genus. In some (e.g. *Cryptocoryne* and *Arisarum*) the spathe completely encloses the spadix, while in others it reflexes to leave the spadix clearly visible (e.g. most *Anthurium*, *Spathiphyllum*). In some genera the spathe is shed as soon as the inflorescence reaches anthesis, either falling completely (e.g. most *Rhaphidophora*) or partially (e.g. *Schismatoglottis*). The spathe ranges in size and form from 5 mm long and simple in *Homalomena humilis* to a fluted and pleated vase-shaped structure 1 m wide and 1.5 m tall in *Amorphophallus titanum*.

The sex of the individual flowers and their arrangement on the spadix are among the characters used to define taxonomic groups. Depending on the genus the spadix may bear either unisexual or bisexual flowers. If bearing bisexual flowers these are uniformly arranged over the spadix. Bisexual flowers are often subtended by reduced tepals termed a perigon. If unisexual, the flowers are usually arranged with the females at the base of the spadix and the males above, with the zones occasionally separated by a further zone of sterile flowers; the spadix is occasionally terminated by a sterile appendix. In the genus *Arisaema* individual inflorescences are usually either male or female and the sex of the inflorescence is governed by the age of the plant, its health and the type of conditions in which it is growing. Young plants, or mature plants in poor condition or growing in a less than ideal habitat, will produce male inflorescences, while mature plants in good condition growing in an optimum habitat will produce female inflorescences. The ability to alter the sex of the inflorescence in this way is termed paradioecy. Unisexual flowers of aroids are almost without exception naked, that is, lacking a perigon.

The family is vegetatively diverse with stem-tubers, climbers, hemi-epiphytes, true epiphytes, emergent and free-floating aquatics all represented. Among the climbing species various types of climbing method may be observed; there are the shingle climbers in which the short-petioled leaves overlap in the manner of roof tiles (e.g. *Scindapsus pictus*), huge trunk climbers (e.g. *Scindapsus latifolius*), and litter-basket climbers displaying differentiation of stem function (*Scindapsus beccarii*). In the last named the young plant is a straggling climber attached by short roots to a tree trunk and bearing small, scattered leaves. When the plant has reached a certain age and height the growth alters to form a congested litter-basket comprised of large, overlapping leaves. The litter-basket produces several inflorescences and then sends out another straggling growth which continues climbing for a few metres before the process is repeated. The Araceae also contains many creeping or tufted forest floor herbs, (e.g. *Hapaline brownii* and *Schismatoglottis tectorata*). Tuberos or cormous-stemmed aroids are frequent, especially in genera occurring in habitats subjected to a seasonal climate. The primarily Old World tropical *Amorphophallus* is especially noteworthy because of the enormous tubers produced by certain species. The largest species, *A. titanum*, can produce tubers weighing approximately

70 kg. Some aroids, termed rheophytes, are adapted to streamside habitats where there exists the risk of flash floods following tropical rains. Rheophytic aroids are especially abundant on the island of Borneo (e.g. *Bucephalandra*, *Aridarum*, *Hottarum*). Other wetland species vary from swamp plants such as the prickly, clump-forming *Lasia spinosa* and the well-known SKUNK CABBAGE (*Lysichiton americanum*) to aquatics such as *Cryptocoryne longicauda* and the remarkable *Jasarum steyermarkii*. The family even contains a free-floating aquatic, the WATER LETTUCE, *Pistia stratiotes*, which can be an aggressive water weed in warm countries.

Many aroids are notable for the physical and chemical means they employ to protect themselves from grazing. The stems and leaves contain copious raphides, calcium oxalate crystals, that become embedded in the soft tissue of the mouth when the plant is chewed. The crystals often act as vectors for toxic or irritating chemicals, helping to inject them and causing severe discomfort. In *Dieffenbachia* the raphides are found inside specialized cells termed idioblasts which forcibly eject their contents when damaged. Another type of defence is found in the subfamily *Monsteroideae*, to which belongs the SWISS-CHEESE PLANT, *Monstera deliciosa*. In this group the leaves, stems and inflorescences contain tough, sclerified cell vascular linings called trichosclereids. In some species the trichosclereids are found in large quantities near the growing apex and around the inflorescence, where they have been shed by the disintegration of the sheaths subtending the apical growth.

The sap of many aroids is strongly caustic. In the case of *Arum*, skin contact with cut surfaces can lead to chapping and blistering, a problem that led to the demise of the use of *Arum* tubers as a source of clothes starch (Prime, 1960; Boyce, 1993). Ingestion of the sap can cause acute throat inflammation, poisoning and, in severe cases, death. Species of the genus *Dieffenbachia* contain a sap that causes intensely painful inflammation of the mucous membrane, tongue and throat. In the eighteenth century it was given to slaves to prevent them from speaking, hence the popular name DUMB CANE.

Almost all Araceae studied to date display insect pollination and many have evolved to be pollinated by insects attracted to dung or carrion (saproentomophily). The British CUCKOO PINT (*Arum maculatum*) is an example of such a plant. Many tropical species have inflorescences where pollination has evolved in conjunction with bees, wasps and beetles. In the species of *Philodendron* investigated to

date, large dynastid scarab beetles are attracted to the inflorescences and appear to be the main pollinators (Gottsberger & Amaral, 1984). Many aroids attract pollinators by producing inflorescence odours which have been equated with those of dung, carrion, rotting fruit, old socks, semen, bad breath, beer, spearmint, cheap sweets and cinnamon. In several genera the spadix heats up considerably during anthesis, often by as much 20°C above the ambient temperature and often producing at the same time a strong, foul odour. Some genera also offer potential pollinators food in the form of fat bodies (*Dieffenbachia*), sugar solutions (many *Arum* species) or oil droplets (*Amorphophallus*).

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