



The inflorescence in Commelinaceae

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ABSTRACT

The structure of the synflorescence and the flowering unit (inflorescence) in Commelinaceae are characterized. The synflorescence is polytelic and the basic inflorescence type is a terminal pedunculate thyrses with an indeterminate central axis to which several to many cincinni are attached. Each thyrses is a florescence, and each cincinnus is a partial florescence. Variations mainly in the number of cincinni and in the number of flowers on each cincinnus determine the main differences found in the inflorescences of the different genera. Hypothesized developmental processes are described, with a view to finding relationships among different models characterized in the family as well as defining characters for cladistic studies, which may be useful to depict all the variations observed and serve as a guide for future phylogenetic studies.

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Introduction

The plant family Commelinaceae consists of about 42 genera and 650 species. It is distributed worldwide and especially diverse in the tropics and warm-temperate regions of America, Africa, Asia and Australia, with centers of diversity in Tropical Africa, Mesoamerica and India (Brashier, 1966; Cronquist, 1981; Faden, 1998; Hardy and Faden, 2004). The inflorescences are characterized as single or compound, commonly panicle-like thyrses composed of several to many scorpioid-cymose branches (cincinni), sometimes reduced to a single cincinnus or, rarely, to a single flower (Cronquist, 1981; Faden, 1998).

The family Commelinaceae exhibits a broad range of diversity, particularly in its floral and inflorescence morphology (Clarke, 1881; Evans et al., 2000; Hunt, 1994). Woodson (1942) and Brennan (1966) considered the inflorescence structure of great importance in the taxonomy of this family. However, the high degree of variation has made difficult assessments of homology among morphological characters, and has resulted in several discordant classification schemes for the family (Evans et al., 2000).

Cladistic studies based on morphological (Evans, 1995; Evans et al., 2000) and molecular data (*rbcL*) (Evans, 1995; Evans et al., 2003) generated apparently incongruent results. The discrepancies between these cladistic studies were attributed to a high amount of homoplasy in the morphological characters, resulting from numerous cases of convergent and/or parallel evolution (Evans et al., 2000).

Homologous characters are extremely important in the study of inflorescences. The typology-based system developed by Troll (1964) and Weberling (1965, 1989) has proved to be useful for describing inflorescences (Rua, 1999) as well as for providing characters for cladistic analyses (Nickol, 1995; Reinheimer, 2007; Rua and Aliscioni, 2002; Tortosa et al., 2004). In fact, Troll's contribution was highlighting the necessity for a comparative morphological approach to discovering homology (Tortosa et al., 2004), which, in turn, he considered central to assess phylogenetic relationships (Troll, 1951). In their research on the inflorescences of *Nassauvia* Comm. ex Juss., Tortosa et al. (2004) have proved that a typological approach may not only be compatible with a cladistic treatment of characters, but also a necessary first step towards constructing hypotheses on primary homology (De Pinna, 1991), which may be suitable for cladistic tests (Rua, 1999). Brennan (1966) and Hardy and Faden (2004) partially applied some typological concepts in the synflorescence of Commelinaceae.

In this review, we analyze the inflorescence diversity in Commelinaceae from a typological point of view, and characterize the different processes which bring about the high diversity of flower organs in this family.

The Commelinaceae synflorescence

The complete flowering branch system produced by an apical bud of the embryonal axis or an innovation bud during a growth season is called synflorescence (Troll, 1964; Weberling, 1965, 1989). The typical synflorescence bears a terminal flowering unit, which ends the main axis of the plant, and axillary flowering units, which are found in the apical region of the distal branches (Sell and Cremers, 1987). The flowering unit represents the charac-

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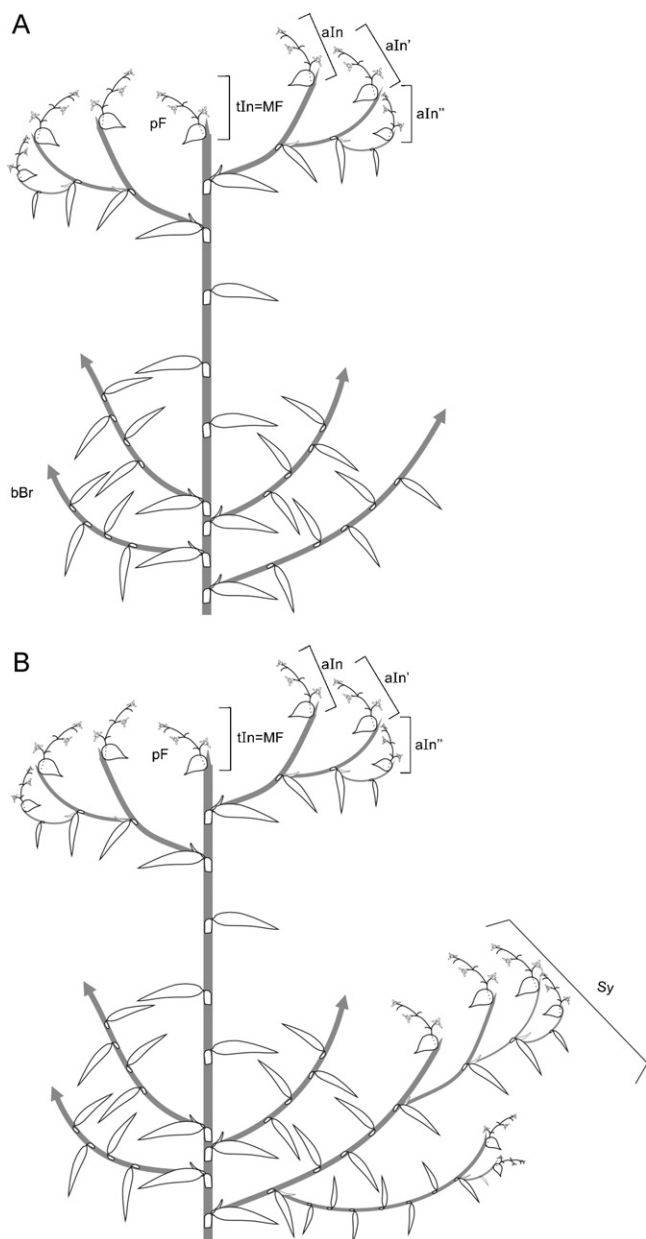


Fig. 1. Synflorescence in *Commelina erecta* L.: (A) Synflorescence from the main axis; (B) Synflorescence from the main axis and from the basal branches. Abbreviations: aln, aln', aln'', axillary inflorescence of consecutive order; bBr, basal branch; MF, main florescence; pF, partial florescence; Sy, synflorescence; tIn, terminal inflorescence.

teristic inflorescence within one species, i.e. the minimum possible flowering expression in any given species. It may be one flower, one florescence, or a more complex system of inflorescence branches (Sell, 1976; Rua, 1999).

Commelinaceae plants (Fig. 1) are characterized by having: (1) a basal zone on the main axis, where basal branches repeating the main axis structure are produced (in perennial species the “innovation zone”); (2) an “inhibition zone” where axillary buds do not develop; (3) a distal zone in which the axillary buds develop “enrichment axes”; and (4) the terminal inflorescence or terminal flowering unit. Each enrichment axis presents a variable number of leaves and ends in a flowering unit (axillary inflorescence). In perennial species (Fig. 1) the plant main axis, as well as each of the basal branches, may be considered a synflorescence, in the sense of Troll (1964).

The Commelinaceae inflorescences are terminal, or terminal and axillar, or, in some genera, all axillar (Brenan, 1966; Faden, 1998). In some species, the inflorescence is basal (e.g. *Geogenanthus* Ule; Faden, 1998). A special type of enrichment axes that produce subterranean inflorescences is present in diploid plants of *Commelina benghalensis* L. This species is able to produce both aerial and subterranean flowers, both of which are borne in leafy bracts (spathes). The aerial flowers (staminate and perfect) are chasmogamous, whereas the subterranean flowers (perfect) develop on rhizomes and are cleistogamous (Webster et al., 2005).

Structure of the Commelinaceae inflorescence

The apical meristem of an inflorescence produces a varying number of bracts and their axillary meristems, and then arrests its growth. The Commelinaceae inflorescence axis (Fig. 2) lacks a terminal flower. The basic inflorescence type is a terminal pedunculate thyrs (Fig. 2A, B, E, F) with an indeterminate central axis to which several to many cincinni are attached (Faden, 1991). Genera with thyriform inflorescences are: *Stanfieldiella* Brenan, *Aneilema* R. Br., *Pollia* Thunb., *Tricarpelema* J.K. Morton, *Pseudoparis* H. Perrier, *Dichorisandra* J.C. Mikan, *Cochliostema* Lem., *Siderasis* Raf., *Spatholirion* Ridl., *Aëtheolirion* Forman, *Streptolirion* Edgew., *Tinantia* Scheidw., *Thyrsanthemum* Pichon, *Floscopa* Lour., *Murdannia* Royle, *Cyanotis* D. Don, *Palisota* Rchb. ex Endl. and *Tricarpelema* (Brenan, 1966; Faden, 1998). In these thyrses, the cincinni may be alternate, subopposite, or subverticillate (Faden, 1998). In some taxa the thyriform inflorescences may be contracted, umbelliform, corymbiform or raceme-like thyrses (Hunt, 1994).

Some genera show a significant variation in the number of cincinni (*Aneilema*, *Murdannia*, *Stanfieldiella*, *Floscopa*, *Tinantia*, *Pollia*, *Dichorisandra*) (Clarke, 1881; Faden, 1998). In some other taxa, the inflorescence has few cincinni: up to 5 cincinni in *Elasis* D.R. Hunt; 1–5 cincinni in *Buforrestia* C. B. Clarke and *Elasis*; 2–3 cincinni in species of *Campelia* Rich.; a pair of cincinni in *Tradescantia* L., *Gibasis* Raf., *Callisia* Loebl. and *Tripogandra* Raf.; 1 (–3) cincinni in species of *Plowmanianthus* Faden & C.R. Hardy; 1–2 cincinni in *Anthericopsis* Engl., *Belosynapsis* Hassk., *Triceratella* Brenan, *Commelina* Mirb., *Commelinopsis* Pichon, *Phaeosphaerion* Hassk., *Anthericopsis*, *Tinantia glabra* (Standl. & Steyererm.) Rohweder and *T. longipedunculata* Standl. & Steyererm. (Brenan, 1966; Faden, 1998; Hunt, 1994).

In *Cartonema* R. Br. the inflorescence consists of an indeterminate axis with solitary flowers (Fig. 2G). Each flower presents its prophyll, whose axillary bud does not develop; it has the appearance of a spiciform raceme but is a depleted thyrs (raceme-like thyrses) – Troll (1964), Brenan (1966); and each flower is considered a 1-flowered cincinnus (Brenan, 1966; Faden, 1998). In *Sauvallea* C. Wright (Fig. 2H) the inflorescence consists of a solitary flower enclosed in a spatheous bract (Brenan, 1966; Evans et al., 2000; Faden, 1998).

In most species there is a single cincinnus per bract; there are 2–5 cincinni per bract in *Murdannia* (Fig. 2), 1 (–3) cincinni in *Polyspatha* Benth. and 1 (–2) cincinni in *Commelina* (Fig. 2D) (Brenan, 1966; Faden, 1998).

The number of flowers of each cincinnus is variable. There is a continuum from cincinni with numerous flowers (*Gibasoides*), through cincinni with few flowers (e.g. *Matudanthus* D.R. Hunt and *Plowmanianthus*), to unflowered cincinni (*Cartonema*, *Sauvallea*, *Plowmanianthus perforans* Faden & C.R. Hardy) – see Evans et al. (2000) and Hardy and Faden (2004).

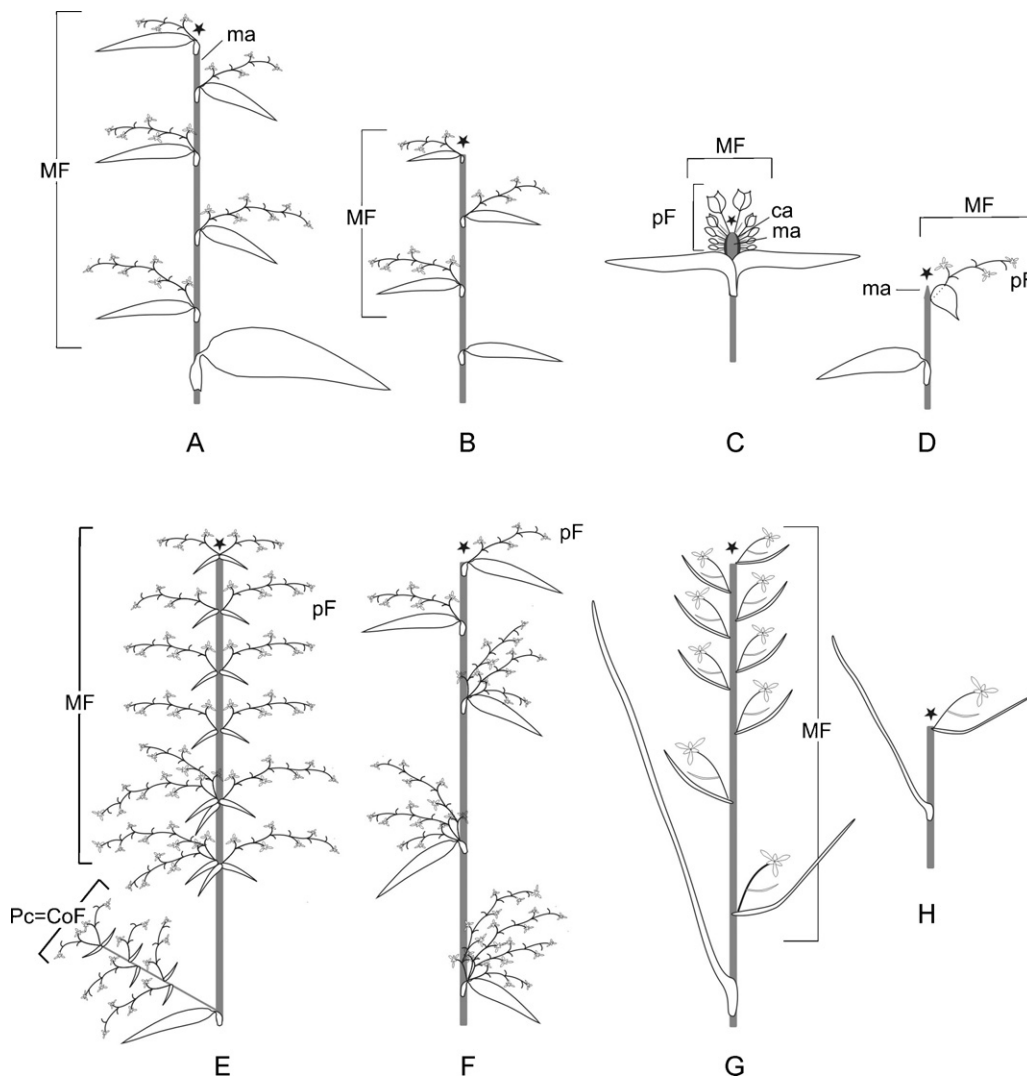


Fig. 2. Inflorescences in Commelinaceae: (A) *Pollia mannii* C.B.Cl.; (B) *Murdannia nudiflora* (L.) Brenan; (C) *Tradescantia zebrina* Bosse; (D) *Commelina erecta* L.; (E) *Murdannia divergens* (C.B.Cl.) Brückn.; (F) *Murdannia spirata* (L.) Brückn.; (G) *Cartonema spicatum* R. Br.; (H) *Sauvallea blainii* Wight. Abbreviations: ca: cincinnus axis; CoF, coflorescence; ma, main axis of the inflorescence; MF, main florescence; Pc, paraclade; pF, partial florescence; ★ truncated main axis of the inflorescence. Diagrams A–C and E–G are according to Brenan (1966).

Structure of the inflorescences in some genera

In species of *Murdannia*, a significant variation of the typical panicle-like thyse with indeterminate main axis can be observed (Fig. 2B, E, F). This genus shows variations in total number of cincinni, number of nodes with cincinni, number of cincinni per node, and degree of development of each cincinnus (flower number of the cincinnus): Brenan (1966). While most species have a thyse, the inflorescence of *Murdannia nudiflora* (L.) Brenan generally has a single cincinnus (Hunt, 1994).

In *Commelina*, the terminal apical meristem produces a spathaceous bract and its axillary meristem, and then arrests its growth after producing a small sterile end of the inflorescence main axis. The axillary meristem forms 1–2 cincinni (Fig. 2D). The inflorescence is terminal and reduced to these cincinni enclosed in the spathaceous bract.

In *Tradescantia* (Brenan, 1966) the inflorescence is terminal, reduced to two spathaceous to foliaceous bracts and their respective two cincinni that are fused with the sterile end of the inflorescence main axis (Fig. 2C). A similar feature can be found in *Anthericopsis sepalosa* (C.B. Clarke) Engl. (Brenan, 1966), in which

the inflorescence seems more visible because of less enclosing bracts. This is also evident in the inflorescence of *Cordia brevispicata* M. Martens & Galeotti (Boraginaceae), which is considered a syndesmy (one type of metatopies, Weberling, 1989).

The inflorescence consists also of pairs of cincinni in *Callisia* and *Tripogandra* (Hunt, 1994). Within the former of these genera, there are a few species with incompletely fused cincinni (*C. warszewicziana* (Kunth & Bouché) D.R. Hunt), whereas most species have cincinni strictly fused in pairs (Hunt, 1994). In *Tripogandra*, the inflorescence lacks subtending bracts (Hunt, 1994).

In some species of *Callisia*, *Tradescantia* and *Tripogandra*, the terminal inflorescence and the axillar inflorescences (each consisting of a pair of cincinni) are grouped together into a lax paniculiform synflorescence [*C. fragans* (Lindley) Woodson, *Tradescantia plusiantha* Standley, *Tradescantia standleyi* Steyerl., *Tripogandra amplexicaulis* (Klotzsch ex C. B. Clarke) Woodson and *Tripogandra grandiflora* (J. D. Smith) Woodson (Hunt, 1994)], or a spiciform synflorescence [*C. soconuscensis* Matuda, *C. repens* (Jacq.) L., *Tripogandra andrieuxii* C. B. Clarke, *T. velutina* Kunth et Bouché, *T. crassifolia* Cav.]. This also occurs in some species of *Callisia*, with the terminal inflorescence and axillar inflorescences forming a paniculiform

synflorescence (Hunt, 1994). Other species of *Tradescantia* have either only terminal inflorescences or both terminal and axillary inflorescences, but these are loosely grouped [*T. deficiens* Brandege, *T. poelliae* D. Hunt, *T. pallida* (Rose) D. Hunt] (Hunt, 1994).

Plowmanianthus shows a pedunculate thyrses usually reduced to a single pedunculate cincinnus (Hardy and Faden, 2004). In species with longer thyrses, one or both very short lateral thyrses, also reduced to one only cincinnus, may develop (Hardy and Faden, 2004).

A special case in the family is observed in inflorescences that show perforation of the leaf sheath, such as *Buforesstia mannii* C.B. Clarke, *Forrestia* and *Coleotrype laurentii* K. Schum. (Brenan, 1966; Clarke, 1881). These taxa have only axillary inflorescences, a trait that is correlated with the forest habitat of these taxa (Evans et al., 2003).

Typological interpretation of the inflorescence

The absence of a terminal flower determines the polytelic character of the Commelinaceae inflorescence (Troll, 1961). In the family (Fig. 2) the main florescence (thyrses) is generally composed by partial florescences (cincinnati). In some taxa one to several paraclades can be observed below the main florescence. These paraclades are reduced to the coflorescence (thyrses). This is the case of *Plowmanianthus* in which the inflorescence of the main thyrses is the main florescence, generally formed by one partial florescence (single cincinnus): Hardy and Faden (2004). The secondary thyrses is a primary paraclade reduced to its coflorescence; this coflorescence is in turn formed by one partial florescence (single cincinnus).

The hypothetical evolutionary processes

Homogenization and truncation are reductive processes pointed out as the most important evolutionary processes in the inflorescences (Weberling, 1989). For different Angiosperm groups, these processes, by progressive or regressive changes, lead to the formation of all types of inflorescences (Kunze, 1989; Maresquelle, 1970; Sell, 1969, 1976). Truncation is the process which produces the change of monotelic to polytelic (Weberling, 1989). Within polytelic inflorescences, truncation may affect the main florescence, the zone of short paraclades and in some cases long paraclades (Rúa and Weberling, 1998; Vegetti, 1991). In Commelinaceae, the truncation affects the number of partial florescences reducing the number of cincinnati, and when the inflorescence is even more reduced only one partial florescence results (one single cincinnus, Fig. 2D).

An increase/reduction of the development degree of the paraclades can also be observed. Generally, in Commelinaceae the inflorescence consists only as the main florescence; in some cases, one to several primary paraclades reduced to the coflorescences are observed. Based on this principal structure an increase/reduction in the branching degree of the primary partial florescence has occurred. The development of the prophyllar bud affects this branching degree and this process affects the number of flowers per partial florescence. If the prophyllar bud does not develop, the inflorescence has a 1-flowered cincinnus (*Cartonema* and *Sauvallea*).

In some species, an increased number of cincinnati per node is observed (Brenan, 1966) (Fig. 2F). This may be related to the important reduction of the internode length of the paraclades or to the development of accessory buds; a character already described for other Monocotyledons (Guarise and Vegetti, 2007). Developmental studies must be carried out in the future in order to determine the origin of multiple cincinnati.

Another process is the reduction or increase of the internode length of the main axis, the partial florescences, or the para-

clades. The shortening of the main axis or paraclade internodes produces: (1) subopposed or pseudovercillate cincinnati (*Pollia*, *Palisota*, *Aclisia* E. Mey.); (2) corymb-like thyrses (*Rhopalephora* Hassk., *Aneilema* Koenigii Wall, *A. paniculatum* Wight, *A. petersii* (Hassk.) C.B. Clarke; *A. brasiliense* C.B. Clarke, *A. sclerocarpum* F. Muell); (3) umbellate thyrses (*Rhoeo* Hance, *Gibasis*, *Gibasoides*, and some species of *Tinantia*), or (4) very congested thyrses (*Amischotolype* Hassk., *Porandra* D.Y. Hong, *Coleotrype* C. B. Clarke, *Weldenia* Schult. f., and *Forrestia*). The shortening/lengthening of the basal internode of the inflorescence produces pedunculate (*Anthericopsis*) or sessile (*Coleotrype*, *Cyanotis*, *Belosynapsis*) or subsessile (*Porandra*) inflorescences. The shortening or lengthening of the basal internode (hypopodium) of the cincinnati produces long pedunculate (*Gibasoides*), pedunculate (*Dichorisandra*) or sessile cincinnati (*Callisia*, *Polyspatha*, *Buforesstia*, *Rhoeo*, *Aploleia* Raf., *Tradescantia*, *Phyodina* Raf., *Campelia*, *Tripogandra*, *Weldenia*, *Cymbispatha* Pichon) (Clarke, 1881; Evans et al., 2000; Faden, 1998). The shortening or lengthening of the pedicel (epipodium) of each flower produces elongate cincinnati (*Pollia*, *Palisota*, *Aclisia*, *Streptolirion*, *Spatholirion*, *Aëtholirion*, *Triceratella*, *Gibasoides*, *Dichorisandra*) or very contracted cincinnati (*Anthericopsis*, *Polyspatha*, *Gibasis*, *Leptorhoeo* C.B. Clarke ex Hemsl.).

Another important process in the appearance of inflorescences is the development or reduction of bracts on the main axis, as well as whether they are caducous or persistent. Variations are also observed in the degree of development, as well as in the caducity or persistence of the prophylls (bracteoles) (Evans et al., 2000; Faden, 1998).

In *Tradescantia*, *Anthericopsis sepalosa*, *Callisia* and *Tripogandra* the inflorescence is the result of the truncation process of the partial florescences, the reduction of the internode length of the main axis and the congenital fusion of cincinnati pairs (Fig. 2C); these inflorescences are a case of syndesmy (Weberling, 1989).

The lack of development of the prophyllar bud of the primary flower produces the spiciform raceme of *Cartonema* (Fig. 2G). This process and the truncation of the median and distal flowers may be related to the reduction of the *Sauvallea* inflorescence to one flower (Fig. 2H). Also, the thyrses-like inflorescences of some Commelinaceae genera may have originated from one spiciform raceme, through the development of the axillary bud of the prophylls in each flower.

All of these processes seem to have operated, either separately or in combination, more than once and in different ways.

Inflorescence characters

Treatment of the inflorescence type as a single compound character seems to be somewhat hazardous, since inflorescence configurations may have resulted from the combination of several developmentally independent characters and processes. Tortosa et al. (2004) propose to consider the hypothesized development processes as “switches” with the aim of finding relationships among the different models observed in the species and defining characters for cladistic studies. Using the characters and processes mentioned before we propose the following list of characters and their states, as a guideline for future phylogenetic research in the Commelinaceae family; characters 8, 13, 15 and 16 are adapted from Evans et al. (2000):

- 1.- Synflorescence structure: 0=only terminal inflorescence; 1=terminal and axillary inflorescence; 2=all axillary or basal inflorescences.
- 2.- Inflorescence structure: 0=only with main florescence; 1=with main florescence and 1– several paraclades.

- 3.- Main florescence structure (flower number per cincinnus): 0 = with partial florescence (more than one flower per cincinnus); 1 = with single flower (only one per cincinnus).
- 4.- Partial florescence number (cincinnus number): 0 = one or two; 1 = more than 2.
- 5.- Flower number in the main florescence (when the main florescence has single flowers): 0 = one; 1 = more than 1.
- 6.- Number of flower per partial florescence (number of flower per cincinnus): 0 = more than one flower per cincinnus; 1 = only one flower per cincinnus.
- 7.- Flower types: 0 = all perfect flowers; 1 = perfect and staminate flowers, randomly distributed; 2 = perfects and staminate flowers, largely separate.
- 8.- Inflorescence peduncle: 0 = well developed; 1 = absent or nearly so.
- 9.- Basal internode length of the main florescence: 0 = not developed (main florescence near to the distal paraclade); 1 = developed (main florescence separated from the distal paraclade). In the absence of paraclades, the basal internode of the main florescence is the basal internode of the inflorescence.
- 10.- Basal internode length of paraclades: 0 = pedunculate paraclade; 1 = paraclade sessile or nearly so.
- 11.- Internode length of the main florescence: 0 = congested thyrses; 1 = lax thyrses.
- 12.- Partial florescences disposition (cincinnus disposition): 0 = alternate; 1 = subopposite or pseudoverticillate. This character is related with the internode length of the main florescence.
- 13.- Internode length of partial florescences (hipopodium): 0 = cincinnus peduncle well developed; 1 = cincinnus peduncle absent or nearly so.
- 14.- Flower pedicel (epipodium): 0 = very contracted cincinnus (sessile flowers or nearly so); 1 = elongated cincinnus (pedicellate flowers).
- 15.- Bract development of partial florescence (cincinnus bract development): 0 = cincinnus bracts small and persistent; 1 = cincinnus bracts all large and foliaceous or spatheous; 2 = some cincinnus bracts large and foliaceous and some small or lacking; 3 = cincinnus bracts grading from large and foliaceous at the proximal region of the inflorescence to small or lacking at the distal regions.
- 16.- Prophyll development: 0 = persistent, not perfoliate; 1 = persistent and perfoliate; 2 = cauducous or absent.
- 17.- Partial florescence number per bract (cincinnus number per bract): 0 = one; 1 = more than one per bract.
- 18.- Inflorescence perforating the leaf sheath: 0 = yes; 1 = no.
- 19.- Cincinni fused with the sterile end of the inflorescence main axis: 0 = yes; 1 = not.

Summarising, the systematic value of the inflorescence in Commelinaceae is the result of the following processes: fate of the terminal and axillary shoot meristem (character 1); developmental degree of the paracladial zone (character 2); degree of florescence development (character 3 and character 5); partial florescence truncation (character 4); developmental degree of the prophyllar bud of each flower (character 6); developmental degree of each flower (character 7); increase/reduction of the internode length (characters 8–14); degree of bract development (character 15); degree of prophyll development (character 16); increased partial florescence number per bract (character 17); inflorescence perforating the leaf sheath (character 18); congenital fusion of the cincinni and the sterile end of the inflorescence main axis (character 19).

Phylogenetic value of the inflorescence

In accord with Evans et al. (2000), discordance between the phylogeny and the past classification of the family is attributed to a high degree of convergence in various morphological characters, particularly those relating to the inflorescence. Obviously are inflorescence characters highly homoplastic in the morphological phylogeny (Evans et al., 2000). It is remarkable that in the combined cladistic analysis (Evans et al., 2003) of morphological and molecular data, characters related with the inflorescence fit better onto the tree topology. For this reason, in this work we try to find novel characters that may be of help for future phylogenetic analyses by morphological or combined approaches.

In the cladistic analyses of Commelinaceae, based on morphological and molecular data (Evans, 1995; Evans et al., 2003), *Cartonema* (subfamily Cartonematoideae) was placed basal to the rest of the family. A comparison of the inflorescence structure of this basal genus (Fig. 2G) with the inflorescences of the subfamily Commelinoideae proves that the cincinni with multiple flowers and the reduction of the cincinnus number (Fig. 2B–D) might be considered derived characters. Throughout the different clades, variations may be observed in the number of cincinni forming the inflorescences, which would indicate that the process of development of a higher number of cincinni/truncation of cincinni has taken place at different times in different groups.

A significant reduction occurs in the structure of the inflorescence in *Sauvallea* (Fig. 2H), a genus located in tribe Tradescantieae as a still uncertain subtribe by Faden (1998). This genus was included by Evans et al. (2000) in the phylogenetic study of Commelinaceae based only on morphological data. In this study, *Sauvallea* appears quite basal together with genera of subtribe Streptoliriinae and genera of the Tradescantieae tribe.

Within the Tradescantieae, the subtribes Palisottinae and Streptoliriinae appear as basal clades, and the genera of subtribes Tradescantiinae and Thyrsantheminae appear as derived clades. Inflorescence characters play an important taxonomic role in distinguishing subtribes within this tribe. In subtribe Streptoliriinae, all genera are characterized by having the lower cincinni with perfect flowers and the upper cincinni with male flowers. In subtribe Cyanotinae the inflorescence has single or aggregated cincinni. In subtribe Coleotrypinae the inflorescences are axillary congested thyrses perforating the sheath. A significant variation in the structure of inflorescences is observed in subtribes Dichorisandrinae and Thyrsantheminae, with thyrses or, sometimes, a reduction to a single cincinnus. In subtribe Thyrsantheminae, important variations are observed in the degree of thyrses congestion. The subtribe Tradescantiinae shows pairs of sessile, contracted cincinni fused with the rudimentary main axis of the inflorescence (Fig. 2C).

In the tribe Commelinaeae, *Anthericopsis* and *Murdannia* appear as basal clades, and *Commelina* as a derived clade. *Anthericopsis* shows inflorescences reduced to 1–2 cincinni (Fig. 2D), while *Murdannia* shows an important inflorescence variation, from multiple-branched thyrses (Fig. 2B, E, F) to inflorescences reduced to a single cincinnus. *Commelina*, which appears as the most derived genus in the family, shows a highly reduced inflorescence, with 1–2 cincinni, and, at the same time, in one of its species it has evolved cleistogamous subterranean inflorescences, in addition to the aerial inflorescences.

Conclusions

It is important to characterize the inflorescence and the synflorescence properly for the Commelinaceae. For comparative purposes, only homologous structures should be compared, that is, inflorescences should only be compared with inflorescences but

not with synflorescences. Of particular interest is the development of multiple cincinni per node in some genera, as well as the particular inflorescence development in *Sauvallea*. We propose here 15 novel characters related with Commelinaceae inflorescences, in addition to those used by Evans et al. (2000) in their morphological cladistic analysis of the family.

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