Diversity and Evolution of Monocots

petaloid monocots

Lilioids - petaloid monocots

The lilioid monocots represent five orders and contain most of the showy monocots such as lilies, tulips, blue flags, and orchids

Majority are defined by 6 features:

1. Terrestrial/epiphytes: plants typically not aquatic

2. Geophytes: herbaceous above ground with below ground modified perennial stems: bulbs, corms, rhizomes, tubers
Lilioids - petaloid monocots

... thus common in two biomes

- temperate forest understory (low light, over-winter)
- Mediterranean (arid summer, cool wet winter)

Lilioids - petaloid monocots

The lilioid monocots represent five orders and contain most of the showy monocots such as lilies, tulips, blue flags, and orchids. Majority are defined by 6 features:

3. Leaves without petiole: leaf blade typically broader and attached directly to stem without petiole

4. Tepals: showy perianth in 2 series of 3 each; usually all petaloid, or outer series not green and sepal-like & with no bracts

5. Nectaries: usually well-developed nectar tissue at the base of ovary or stamens; insect or bird-pollinated
Lilioids - petaloid monocots

The lilioid monocots represent five orders and contain most of the showy monocots such as lilies, tulips, blue flags, and orchids.

Majority are defined by 6 features:

6. Capsule/berry: fruit a 3-parted capsule or berry

Systematic issues with this group:

Exceptions abound!! - most people have classified Pontederiaceae with lilioids (tepals, nectar)

Systematic issues with this group:

CA 3   CO 3   A 6   G (3)

The floral pattern in "Liliaceae" is plesiomorphic (primitive) for the entire group of petaloid monocots.

Will the real "Liliaceae" please stand up!

... and anything deviating from the generalized form has been placed in separate families.

Lilium - lily (Liliaceae)

Systematic issues with this group:

Will the real "Liliaceae" please stand up!

e.g., Trilliaceae for flowers with 3 green sepals.

Trillium - trillium

Pontederia cordata - Pickerel weed [Commelinid]
Lilioids - petaloid monocots

Systematic issues with this group:
Will the real "Liliaceae" please stand up!

... and anything deviating from the generalized form has been placed in separate families

e.g., Amaryllidaceae for flowers with inferior ovary

Eucharis

Lilioids - petaloid monocots

Systematic issues with this group:
Will the real "Liliaceae" please stand up!

... and anything deviating from the generalized form has been placed in separate families

e.g., Smilacaceae for viney plants with petioled leaves

Smilax - catbriar

Lilioids - petaloid monocots

Systematic issues with this group:
Will the real "Liliaceae" please stand up!

... and anything deviating from the generalized form has been placed in separate families

e.g., many families that are "woody"

Dracaena - dragon tree

Lilioids - petaloid monocots

Systematic issues with this group:
Will the real "Liliaceae" please stand up!

Liliaceae thus included a lot of unrelated taxa that are now placed in at least three orders

warning: Gleason&Cronquist & UW Herbarium website still use Liliaceae sensu lato (in the broad sense)

warning: the new Michigan Flora and Wisconsin Flora use lilioid families incorrectly!
Lilioids - petaloid monocots

See last page of lab handouts for correct placement of genera into families:

<table>
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<tr>
<th>Orders</th>
<th>Lilioids</th>
<th>Monocots</th>
<th>Petaloid Monocots</th>
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<tbody>
<tr>
<td>Liliales</td>
<td>*Liliaceae s.s.</td>
<td>Lilies</td>
<td>North temperate family of 16 genera and 700 species</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• bulb or rhizomatous perennials</td>
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<td>• leaves without petioles, stemmed or basal</td>
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<td></td>
<td></td>
<td>• &quot;Liliaceae&quot; flower (tepals) but often spotted</td>
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<td></td>
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<td></td>
<td>• capsule or berry</td>
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<td>Medeola virginica - Indian cucumber root</td>
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<td>Lilium - lily (Liliaceae)</td>
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</tbody>
</table>
**Liliales: *Liliaceae s.s.* - lilies**

*Clintonia borealis* - Yellow blue-bead lily

*Erythronium americanum* - yellow trout lily

*Tulipa sp.* - tulip

**Liliales: Smilacaceae - catbriars**

Small family, mainly of South Hemisphere, climbers via tendrils (modified stipules), starchy tubers, large, net-veined leaves and definite petiole

*Smilax herbacea* - bristly greenbriar

Flowers unisexual, dioecious plants; carrion flowers are foetid

Male umbel  Female umbel

Fruit an umbel of black berries (red berries are from jack-in-the pulpit)
Liliales: Melanthiaceae

*Trillium grandiflorum* - large flowered trillium

*Trillium recurvatum* - prairie trillium

Liliales: Melanthiaceae

*Zigadenus death camas*

*Zerophyllum beargrass*

Liliales: Colchicaceae

*Uvularia grandiflora - bellwort*

Liliales: Colchicaceae

*Colchicum autumnale - meadow saffron*

Disrupts spindle mechanism in mitosis
Asparagales: sister to the Commelinids

- in the Liloid grade, Asparagales is sister to the Commelinids
- characterized by phytomelan in seed coats and arum-type mychorrizal connection (vs. Paris-type in Liliales)

Asparagales: sister to the Commelinids

- much of the order Asparagales had been included in "Liliaceae"
- Orchidaceae is sister to the rest of the order
- Iridaceae (iris family) is the other large family

Asparagales: Asparagaceae

Asparagus officinalis - asparagus

Asparagales: Asparagaceae (Ruscaceae)

Maianthemum canadense - wild lily of the valley
Asparagales: Asparagaceae (Ruscaceae)

- Smilacina = Maianthemum

- False Solomon's-seal

Asparagales: Asparagaceae (Agavaceae)

- Yucca whipplei (and yucca moth)
- Yucca brevifolia: Joshua Tree in Mohave

Asparagales: Asparagaceae (Hyacinthaceae)

- Scilla sibirica: English bluebell

- Dracaena draco - dragon tree of Canary Islands
- Dracaena marginata - houseplant from Madagascar
- Sansevieria - mother-in-law tongue
Narcissus sp. - daffodil
• inferior ovary
• corona (staminal)

Hymenocallis - spider lily

Grass Trees [Xanthorrhoeaceae]

Allium tricoccum - Wild leak (umbels and S compounds)

Hemerocallis fulva - day lily
[Hemerocallidaceae]
Asparagales: Xanthorrhoeaceae

Haworthia [Asphodelaceae]

Asparagales: *Iridaceae - iris

Iridaceae always recognized as distinctive family of lilioids

A family primarily of Mediterranean climate geophytes.
Leaves are basal and equitant - folded and overlapping.

Iris virginica - Blue flag, iris

Tepals 6, the 3 inner (petals) forming the "flags or standards"
The 3 outer (sepals) forming the "falls" with nectar guides
The 3 stamens are positioned under the 3 petal-like styles
The gynoecium is inferior and forms a 3-parted capsule
Asparagales: *Iridaceae - iris

* Iris virginica - Blue flag, iris

* Iris versicolor - Blue flag

* Iris pseudacorus - Yellow flag
  Introduced and potentially invasive

* Iris lacustris - Dwarf lake iris
  Endangered species
  restricted to fringe areas
  of northern Great Lakes;
  clonal growth

* Sisyrinchium campestre - blue-eyed grass
Crocus vernalis - crocus cultivated
Crocuses are all introduced but are some of the earliest flowering plants in the spring.

Asparagales: *Iridaceae - iris

Crocus sativus - saffron cultivated
The dried styles of *C. sativus* yields the expensive saffron.

Geissorhiza - South Africa
Large radiations occur in several genera in Mediterranean climate regions of South Africa

Moraea - peacock lily

Asparagales: *Iridaceae - iris

Hypoxis hirsuta - Yellow star grass
Family has been placed in Liliaceae or Amaryllidaceae but is now known to be near Iridaceae.