

## SUPPORTING MATERIAL

# CHARACTER TABLES FOR FAMILIES OF THE NON-ARBOREAL, SPRING-FLOWERING FLORA OF THE EASTERN PIEDMONT OF NORTH CAROLINA

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**Abstract.** A multi-access key (MAK) is a data set in which each taxon is evaluated for each character in the key. MAKs can facilitate plant identification because they allow users to select characters for identifications. A recent study found that inexperienced users did not benefit from the character choice feature of a MAK but suggested that more experienced users might benefit. All of the tables of the MAK to the spring-flowering, non-arboreal flora of the eastern Piedmont in North Carolina used in the study were not previously published due to space constraints in the printed journal (*J. North Carolina Acad. Sci.*). The purpose of the current article is to present an alphabetical list of all sixty-six plant families in the MAK, explanations of all characters and character states, a list of character states, each of which occurs in few families, and the thirteen character tables.

**Keywords:** multi-access key, dichotomous key, pedagogy, field botany.

A multi-access key (MAK) is a data set in which each taxon is evaluated for each character in the key. MAKs can facilitate plant identification because they allow users to select characters for identifications (Leenhouts 1966). Character choice allows users to avoid problematic characters, select character states shared by few taxa early in the keying process, and confirm tentative identifications with characters other than those used in the original identification. Traditional dichotomous keys afford little character choice. Stucky et al. (2006) found that inexperienced users did not benefit from the character choice feature of a MAK, but suggested that more experienced users

might benefit. They also suggested that MAKs may be preferable to dichotomous keys for identifying incomplete specimens.

Stucky et al. (2006) did not present all of the tables of their MAK to the spring-flowering, non-arboreal flora of the eastern Piedmont in North Carolina because these tables would have occupied too much space in the printed journal. The purpose of the current article is to present an alphabetical list of all sixty-six plant families in the MAK (Table 1), explanations of all characters and character states (Table 2), a list of character states, each of which occurs in few families (Table 3), and the thirteen character tables (Tables 4–16).

## METHODS

The sequence of steps to determine a plant family with the MAK is described here: (1) Compare the specimen with the list of character states of limited occurrence (Table 3) because the presence of such a character state would quickly limit the family possibilities to a few. If the specimen does not demonstrate a character state of limited occurrence, (2) choose a character from the character list (Table 1) that is clearly exhibited by the specimen. On the corresponding character table, determine which plant families exhibit the character

state that is observed on the specimen and circle all of these families on the plant family list. (3) Choose a second character and determine on the corresponding character table the families which exhibit the character state observed on the specimen. Families that were initially circled in step 2 but which do not also have the second character state are eliminated from consideration. (4) Continue the preceding steps until only a single family remains.

## RESULTS

Character tables for calyx and corolla were not included because some users often misinterpret these structures. Character states for the 66 plant families were determined from published keys, descriptions (Radford et al. 1968; Watson & Dallwitz 1992 onwards; Zomlefer 1994; Walters &

Keil 1996; Stucky 2002), and herbarium specimens (NCSC). Monocot and dicot families were listed together alphabetically on each character table. Family treatment and nomenclature followed Radford et al. (1968).

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TABLE 1. Families of spring-flowering herbs, vines, and shrubs of the eastern North Carolina Piedmont.

Amaryllidaceae	Boraginaceae	Elaeagnaceae	Lauraceae	Polemoniaceae	Staphyleaceae
Annonaceae	Brassicaceae	Ericaceae	Liliaceae	Polygonaceae	Styracaceae
Apiaceae	Calycanthaceae	Euphorbiaceae	Loganiaceae	Portulacaceae	Symplocaceae
Apocynaceae	Campanulaceae	Fabaceae	Magnoliaceae	Ranunculaceae	Thymeleaceae
Aquifoliaceae	Caprifoliaceae	Fumariaceae	Malvaceae	Rhamnaceae	Valerianaceae
Araceae	Caryophyllaceae	Gentianaceae	Oleaceae	Rosaceae	Violaceae
Araliaceae	Celastraceae	Geraniaceae	Onagraceae	Rubiaceae	
Aristolochiaceae	Commelinaceae	Hippocastanaceae	Orchidaceae	Salicaceae	
Asteraceae	Crassulaceae	Hydrophyllaceae	Oxalidaceae	Santalaceae	
Berberidaceae	Cyperaceae	Iridaceae	Papaveraceae	Sauraceae	
Betulaceae	Diapensiaceae	Juncaceae	Plantaginaceae	Saxifragaceae	
Bignoniaceae	Dioscoreaceae	Lamiaceae	Poaceae	Scrophulariaceae	

TABLE 2. Characters and character states included in MAK.

<b>Carpel Number</b> (number of units composing gynoecium): 0 (male flower), 1, 2, 3, 4, 5, 6, 7, > 10.	<b>Perianth Part Number</b> (number of separate parts or number of connate parts): 0, 3, 4, 5, 6, 7, 8, 9, 10, > 10.
<b>Flower Sexuality:</b> Perfect (male and female), Imperfect (male or female).	<b>Perianth Symmetry:</b> Regular (actinomorphic or radial), Irregular (zygomorphic or bilateral), Not Applicable (perianth lacking).
<b>Fruit Texture</b> (at maturity): Dry, Fleshy (juicy).	<b>Stamen Fusion:</b> Adnation, Connation, Free (no fusion), Not Applicable (one stamen or female flower).
<b>Leaf Arrangement:</b> Alternate, Opposite, Whorled, Basal (none or very few on aerial stem).	<b>Stamen Number:</b> 0 (female flower), 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, > 10.
<b>Leaf Type:</b> Simple/Unlobed, Simple/Lobed, Simple/Dissected or Divided, Compound/Trifoliolate, Compound/Decomound or Dissected, Compound/Pinnately, Compound/Palmately.	<b>Stem Class:</b> Woody/Non-Vine, Woody/Vine, Herb/Non-Vine, Herb/Vine, Herb/Scape, Herb/Stolon, Underground (plant acaulescent).
<b>Ovary Position:</b> Inferior (epigynous flower), Partly Inferior (perigynous flower), Superior (hypogynous flower), Not Applicable (male flower or female flower lacking perianth).	<b>% Carpel Length Connate:</b> 0 (apocarp), < 70, ≥ 70, Not Applicable (one carpel or male flower).
<b>Perianth Part Adnation:</b> Present (some or all parts adnate), Absent (no parts adnate), Not Applicable (perianth not present).	

TABLE 3. Character states of limited occurrence.

<i>Character State</i>	<i>Families of Occurrence</i>
Anthers appendaged	Ericaceae, Violaceae
Broken tissue aromatic	Aristolochiaceae, Lauraceae
Broken tissue malodorous	Annonaceae
Broken tissue with milky latex	Apocynaceae, Asteraceae, Euphorbiaceae
Broken tissue with reddish juice	Papaveraceae
Golden glands on bottom leaf surface	Ericaceae
Inflorescence a spathe and spadix	Araceae
Inflorescence an umbel	Apiaceae, Araliaceae, Liliaceae, Ranunculaceae
Ovary 4-lobed	Boraginaceae, Lamiaceae
Petals each deeply 2-cleft	Caryophyllaceae
Pith of woody stem chambered	Saxifragaceae, Symplocaceae
Sharp stem enations (prickles, spines, or thorns)	Araliaceae, Elaeagnaceae, Liliaceae, Rosaceae
Staminal filaments bearded	Commelinaceae
Stem branching dichotomous	Valerianaceae
Stem square in cross-section	Lamiaceae, Rubiaceae
Stem triangular in cross-section	Cyperaceae
Stipular scar completely encircles stem	Magnoliaceae
Stipule sheathing stem	Polygonaceae

TABLE 4. Leaf arrangement character table.

<i>Alternate</i>		<i>Opposite</i>	<i>Whorled</i>	<i>Basal</i>
Amaryllidaceae	Polygonaceae	Apocynaceae	Dioscoreaceae	Amaryllidaceae
Annonaceae	Portulacaceae	Asteraceae	Ericaceae	Apiaceae
Apiaceae	Ranunculaceae	Berberidaceae	Lilaceae	Araceae
Apocynaceae	Rhamnaceae	Bignoniaceae	Orchidaceae	Aristolochiaceae
Aquifoliaceae	Rosaceae	Brassicaceae	Rubiaceae	Asteraceae
Araceae	Salicaceae	Calycanthaceae		Brassicaceae
Araliaceae	Santalaceae	Caprifoliaceae		Cyperaceae
Asteraceae	Saururaceae	Caryophyllaceae		Diapensiaceae
Betulaceae	Saxifragaceae	Celastraceae		Fumariaceae
Boraginaceae	Scrophulariaceae	Euphorbiaceae		Geraniaceae
Brassicaceae	Styracaceae	Gentianaceae		Iridaceae
Campanulaceae	Symplocaceae	Geraniaceae		Juncaceae
Commelinaceae	Thymeleaceae	Hippocastanaceae		Liliaceae
Crassulaceae	Violaceae	Lamiaceae		Lamiaceae
Cyperaceae		Loganiaceae		Orchidaceae
Dioscoreaceae		Oleaceae		Oxalidaceae
Elaeagnaceae		Onagraceae		Papaveraceae
Ericaceae		Polemoniaceae		Plantaginaceae
Euphorbiaceae		Portulacaceae		Ranunculaceae
Fabaceae		Rubiaceae		Rosaceae
Fumariaceae		Santalaceae		Saxifragaceae
Geraniaceae		Scrophulariaceae		Violaceae
Hydrophyllaceae		Staphyleaceae		
Iridaceae		Valerianaceae		
Juncaceae				
Lauraceae				
Liliaceae				
Magnoliaceae				
Malvaceae				
Onagraceae				
Orchidaceae				
Oxalidaceae				
Poaceae				

TABLE 5. Stem class character table.

WOODY		HERBACEOUS				UNDER- GROUND (plant is acaulescent)
<i>Non-vine</i>	<i>Vine</i> (climbing or prostrate)	<i>Aerial &amp; Non-vine</i>	<i>Scapae</i>	<i>Vine</i> (tendrillate or prostrate)	<i>Stolon</i>	
Annonaceae	Apocynaceae	Apiaceae	Amaryllidaceae	Apocynaceae	Lamiaceae	Araceae
Aquifoliaceae	Bignoniaceae	Apocynaceae	Apiaceae	Dioscoreaceae	Oxalidaceae	Aristolochiaceae
Araliaceae	Caprifoliaceae	Araceae	Araceae	Fabaceae	Rosaceae	Diapensiaceae
Betulaceae	Ericaceae	Asteraceae	Asteraceae	Polygonaceae	Saxifragaceae	Violaceae
Calycanthaceae	Fabaceae	Berberidaceae	Brassicaceae	Rubiaceae	Violaceae	
Caprifoliaceae	Liliaceae	Boraginaceae	Cyperaceae			
Celastraceae	Loganiaceae	Brassicaceae	Fumariaceae			
Elaeagnaceae	Ranunculaceae	Campanulaceae	Iridaceae			
Ericaceae		Caryophyllaceae	Juncaceae			
Fabaceae		Commelinaceae	Liliaceae			
Hippocastanaceae		Crassulaceae	Orchidaceae			
Lauraceae		Cyperaceae	Papaveraceae			
Magnoliaceae		Ericaceae	Plantaginaceae			
Oleaceae		Euphorbiaceae	Ranunculaceae			
Ranunculaceae		Fabaceae	Saxifragaceae			
Rhamnaceae		Fumariaceae				
Rosaceae		Gentianaceae				
Salicaceae		Geraniaceae				
Santalaceae		Hydrophyllaceae				
Saxifragaceae		Iridaceae				
Staphyleaceae		Juncaceae				
Styracaceae		Lamiaceae				
Symplocaceae		Liliaceae				
Thymeleaceae		Malvaceae				
		Onagraceae				
		Orchidaceae				
		Oxalidaceae				
		Papaveraceae				
		Poaceae				
		Polemoniaceae				
		Polygonaceae				
		Portulacaceae				
		Ranunculaceae				
		Rosaceae				
		Rubiaceae				
		Santalaceae				
		Saururaceae				
		Scrophulariaceae				
		Valerianaceae				
		Violaceae				

TABLE 6. Fruit texture character table.

<i>Dry</i>				<i>Fleshy</i>	
Amaryllidaceae	Celastraceae	Hippocastanaceae	Oxalidaceae	Santalaceae	Berberidaceae
Apiaceae	Commelinaceae	Hydrophyllaceae	Papaveraceae	Saururaceae	Calycanthaceae
Apocynaceae	Crassulaceae	Iridaceae	Plantaginaceae	Saxifragaceae	Caprifoliaceae
Aristolochiaceae	Cyperaceae	Juncaceae	Poaceae	Scrophulariaceae	Elaeagnaceae
Asteraceae	Diapensiaceae	Lamiaceae	Polemoniaceae	Staphyleaceae	Ericaceae
Betulaceae	Dioscoreaceae	Liliaceae	Polygonaceae	Styracaceae	Lauraceae
Bignoniaceae	Ericaceae	Loganiaceae	Portulacaceae	Symplocaceae	Liliaceae
Boraginaceae	Euphorbiaceae	Magnoliaceae	Ranunculaceae	Valerianaceae	Oleaceae
Brassicaceae	Fabaceae	Malvaceae	Rhamnaceae	Violaceae	Ranunculaceae
Calycanthaceae	Fumariaceae	Oleaceae	Rosaceae		Rosaceae
Campanulaceae	Gentianaceae	Onagraceae	Rubiaceae		Rubiaceae
Caryophyllaceae	Geraniaceae	Orchidaceae	Salicaceae		Thymeleaceae

TABLE 7. Ovary position character table.

<i>Superior</i>		<i>Inferior</i>	<i>Partly Inferior</i>	<i>Not applicable</i> (flowers male)
Annonaceae	Magnoliaceae	Amaryllidaceae	Apocynaceae	Apiaceae
Apocynaceae	Malvaceae	Apiaceae	Portulacaceae	Aquifoliaceae
Aquifoliaceae	Oleaceae	Araliaceae	Saxifragaceae	Araceae
Araceae	Oxalidaceae	Aristolochiaceae	Styracaceae	Betulaceae
Aristolochiaceae	Papaveraceae	Asteraceae	Symplocaceae	Crassulaceae
Berberidaceae	Plantaginaceae	Betulaceae		Cyperaceae
Bignoniaceae	Poaceae	Campanulaceae		Dioscoreaceae
Boraginaceae	Polemoniaceae	Caprifoliaceae		Euphorbiaceae
Brassicaceae	Polygonaceae	Dioscoreaceae		Hippocastanaceae
Calycanthaceae	Portulacaceae	Elaeagnaceae		Lauraceae
Caryophyllaceae	Rhamnaceae	Ericaceae		Oleaceae
Celastraceae	Rosaceae	Iridaceae		Polygonaceae
Commelinaceae	Salicaceae	Onagraceae		Ranunculaceae
Crassulaceae	Saxifragaceae	Orchidaceae		Salicaceae
Cyperaceae	Scrophulariaceae	Portulacaceae		Santalaceae
Diapensiaceae	Staphyleaceae	Rosaceae		
Ericaceae	Styracaceae	Rubiaceae		
Euphorbiaceae	Symplocaceae	Santalaceae		
Fabaceae	Thymeleaceae	Valerianaceae		
Fumariaceae	Violaceae			
Gentianaceae				
Geraniaceae				
Hippocastanaceae				
Hydrophyllaceae				
Juncaceae				
Lamiaceae				
Lauraceae				
Liliaceae				
Loganiaceae				

TABLE 8. Flower sexuality character table.

<i>Perfect</i>			<i>Imperfect</i>	
Amaryllidaceae	Celastraceae	Loganiaceae	Rubiaceae	Apiaceae
Annonaceae	Commelinaceae	Magnoliaceae	Santalaceae	Aquifoliaceae
Apiaceae	Crassulaceae	Malvaceae	Saururaceae	Araceae
Apocynaceae	Diapensiaceae	Oleaceae	Saxifragaceae	Asteraceae
Araceae	Elaeagnaceae	Onagraceae	Scrophulariaceae	Betulaceae
Araliaceae	Ericaceae	Orchidaceae	Staphyleaceae	Crassulaceae
Aristolochiaceae	Fabaceae	Oxalidaceae	Styracaceae	Cyperaceae
Asteraceae	Fumariaceae	Papaveraceae	Symplocaceae	Dioscoreaceae
Berberidaceae	Gentianaceae	Plantaginaceae	Thymeleaceae	Euphorbiaceae
Bignoniaceae	Geraniaceae	Poaceae	Valerianaceae	Hippocastanaceae
Boraginaceae	Hippocastanaceae	Polemoniaceae	Violaceae	Lauraceae
Brassicaceae	Hydrophyllaceae	Polygonaceae		Oleaceae
Calycanthaceae	Iridaceae	Portulacaceae		Polygonaceae
Campanulaceae	Juncaceae	Ranunculaceae		Ranunculaceae
Caprifoliaceae	Lamiaceae	Rhamnaceae		Salicaceae
Caryophyllaceae	Liliaceae	Rosaceae		Santalaceae

TABLE 9. Perianth symmetry character table.

<i>Regular</i>		<i>Irregular</i>	<i>Not applicable</i> (perianth absent)
Amaryllidaceae	Lauraceae	Asteraceae	Araceae
Annonaceae	Liliaceae	Bignoniaceae	Betulaceae
Apiaceae	Loganiaceae	Caprifoliaceae	Cyperaceae
Aquifoliaceae	Magnoliaceae	Comelinaceae	Euphorbiaceae
Apocynaceae	Malvaceae	Ericaceae	Oleaceae
Araceae	Oleaceae	Fabaceae	Poaceae
Araliaceae	Onagraceae	Fumariaceae	Salicaceae
Aristolochiaceae	Oxalidaceae	Hippocastanaceae	Saururaceae
Asteraceae	Papaveraceae	Lamiaceae	
Berberidaceae	Polemoniaceae	Orchidaceae	
Betulaceae	Polygonaceae	Scrophulariaceae	
Boraginaceae	Portulacaceae	Violaceae	
Brassicaceae	Plantaginaceae		
Calycanthaceae	Ranunculaceae		
Campanulaceae	Rhamnaceae		
Caprifoliaceae	Rosaceae		
Caryophyllaceae	Rubiaceae		
Celastraceae	Salicaceae		
Commelinaceae	Santalaceae		
Crassulaceae	Saururaceae		
Dioscoreaceae	Saxifragaceae		
Diapensiaceae	Staphyleaceae		
Elaeagnaceae	Styracaceae		
Ericaceae	Symplocaceae		
Gentianaceae	Thymeleaceae		
Geraniaceae	Valerianaceae		
Hydrophyllaceae			
Iridaceae			
Juncaceae			

TABLE 10. Stamen fusion character table.

<i>Free</i>		<i>Adnation</i>	<i>Connation</i>	<i>Not applicable</i> (stamen one or absent)
Annonaceae	Rhamnaceae	Amaryllidaceae	Araceae	Apiaceae
Apiaceae	Rosaceae	Apocynaceae	Asteraceae	Aquifoliaceae
Araceae	Salicaceae	Aquifoliaceae	Campanulaceae	Araceae
Araliaceae	Santalaceae	Aristolochiaceae	Diapensiaceae	Asteraceae
Aristolochiaceae	Saururaceae	Bignoniaceae	Fabaceae	Betulaceae
Berberidaceae	Saxifragaceae	Boraginaceae	Fumariaceae	Crassulaceae
Betulaceae	Staphyleaceae	Campanulaceae	Iridaceae	Cyperaceae
Brassicaceae	Styracaceae	Caprifoliaceae	Malvaceae	Dioscoreaceae
Calycanthaceae	Symplocaceae	Celastraceae	Orchidaceae	Euphorbiaceae
Campanulaceae	Valerianaceae	Diapensiaceae	Rosaceae	Lauraceae
Caryophyllaceae	Violaceae	Elaeagnaceae	Violaceae	Oleaceae
Celastraceae		Gentianaceae		Polygonaceae
Commelinaceae		Hydrophyllaceae		Ranunculaceae
Crassulaceae		Lamiaceae		Salicaceae
Cyperaceae		Loganiaceae		Santalaceae
Dioscoreaceae		Oleaceae		
Ericaceae		Onagraceae		
Geraniaceae		Orchidaceae		
Hippocastanaceae		Plantaginaceae		
Iridaceae		Polemoniaceae		
Juncaceae		Portulacaceae		
Lauraceae		Rubiaceae		
Liliaceae		Saxifragaceae		
Magnoliaceae		Scrophulariaceae		
Oxalidaceae		Thymeleaceae		
Papaveraceae				
Poaceae				
Polygonaceae				
Portulacaceae				
Ranunculaceae				

TABLE 11. Carpel number character table. 0 = flowers male

0	1	2		3	
Apiaceae	Araceae	Apiaceae	Loganiaceae	Amaryllidaceae	Liliaceae
Aquifoliaceae	Berberidaceae	Apocynaceae	Oleaceae	Araceae	Orchidaceae
Araceae	Elaeagnaceae	Araceae	Papaveraceae	Araliaceae	Polemoniaceae
Betulaceae	Hydrophyllaceae	Araliaceae	Plantaginaceae	Campanulaceae	Polygonaceae
Crassulaceae	Lauraceae	Asteraceae	Poaceae	Caprifoliaceae	Portulacaceae
Cyperaceae	Ranunculaceae	Betulaceae	Rosaceae	Caryophyllaceae	Rhamnaceae
Dioscoreaceae	Rosaceae	Bignoniaceae	Rubiaceae	Celastraceae	Rosaceae
Euphorbiaceae	Thymeleaceae <sup>1</sup>	Boraginaceae	Salicaceae	Commelinaceae	Santalaceae
Hippocastanaceae		Brassicaceae	Santalaceae	Cyperaceae	Saururaceae
Lauraceae		Campanulaceae	Saxifragaceae	Diapensiaceae	Staphyleaceae
Oleaceae		Caprifoliaceae	Scrophulariaceae	Dioscoreaceae	Styracaceae
Polygonaceae		Cyperaceae	Thymeleaceae <sup>1</sup>	Ericaceae	Symplocaceae
Ranunculaceae		Fumariaceae		Euphorbiaceae	Valerianaceae
Salicaceae		Gentianaceae		Hippocastanaceae	Violaceae
Santalaceae		Hydrophyllaceae		Iridaceae	
		Lamiaceae		Juncaceae	
4	5	6	7	>10	
Aquifoliaceae	Annonaceae	Portulacaceae	Annonaceae	Annonaceae	Annonaceae
Araliaceae	Aquifoliaceae	Rosaceae	Aquifoliaceae	Aquifoliaceae	Calycanthaceae
Aristolochiaceae	Araliaceae	Santalaceae	Aristolochiaceae		Magnoliaceae
Caprifoliaceae	Aristolochiaceae				Malvaceae
Crassulaceae	Caprifoliaceae				Ranunculaceae
Ericaceae	Caryophyllaceae				Rosaceae
Onagraceae	Celastraceae				
Rosaceae	Crassulaceae				
Rubiaceae	Ericaceae				
Santalaceae	Geraniaceae				
Saururaceae	Oxalidaceae				

<sup>1</sup> Thymeleaceae has two carpels but usually one fails to develop.

TABLE 12. Percent carpel length connate character table. Unclassified/Incompletely Classified Families: Portulacaceae, Santalaceae, Thymeleaceae.

Not Applicable	0 %	< 70%	> 70%		
Apiaceae	Annonaceae	Apiaceae	Amaryllidaceae	Diapensiaceae	Poaceae
Araceae	Calycanthaceae	Apocynaceae	Apiaceae	Dioscoreaceae	Polemoniaceae
Aquifoliaceae	Crassulaceae	Araliaceae	Apocynaceae	Ericaceae	Polygonaceae
Betulaceae	Magnoliaceae	Betulaceae	Aquifoliaceae	Euphorbiaceae	Portulacaceae
Crassulaceae	Ranunculaceae	Rosaceae	Araceae	Fumariaceae	Plantaginaceae
Cyperaceae	Rosaceae	Saururaceae	Araliaceae	Gentianaceae	Rhamnaceae
Dioscoreaceae	Saururaceae	Saxifragaceae	Aristolochiaceae	Geraniaceae	Rosaceae
Elaeagnaceae		Staphyleaceae	Asteraceae	Hippocastanaceae	Rubiaceae
Euphorbiaceae			Berberidaceae	Hydrophyllaceae	Salicaceae
Fabaceae			Betulaceae	Iridaceae	Scrophulariaceae
Hippocastanaceae			Bignoniaceae	Juncaceae	Staphyleaceae
Hydrophyllaceae			Boraginaceae	Lamiaceae	Styracaceae
Lauraceae			Brassicaceae	Liliaceae	Symplocaceae
Oleaceae			Campanulaceae	Loganiaceae	Valerianaceae
Polygonaceae			Caprifoliaceae	Malvaceae	Violaceae
Ranunculaceae			Caryophyllaceae	Oleaceae	
Rosaceae			Celastraceae	Onagraceae	
Salicaceae			Commelinaceae	Orchidaceae	
Santalaceae			Crassulaceae	Oxalidaceae	
			Cyperaceae	Papaveraceae	



TABLE 13. Perianth part number character table<sup>a</sup>. Unclassified Families: Rhamnaceae, Thymeleaceae.

0	3	4	5	6	
Araceae	Aristolochiaceae	Araceae	Apiaceae	Amaryllidaceae	Orchidaceae
Betulaceae		Betulaceae	Araliaceae	Araceae	Portulacaceae
Cyperaceae		Elaeagnaceae	Asteraceae	Commelinaceae	Ranunculaceae
Euphorbiaceae		Plantaginaceae	Caryophyllaceae	Dioscoreaceae	
Oleaceae		Rubiaceae	Malvaceae	Fumariaceae	
Poaceae		Santalaceae	Ranunculaceae	Iridaceae	
Salicaceae			Santalaceae	Juncaceae	
Saururaceae			Symplocaceae	Lauraceae	
			Valerianaceae	Liliaceae	
				Magnoliaceae	
7	8	9	10		>10
Magnoliaceae	Aquifoliaceae	Annonaceae	Aquifoliaceae	Lamiaceae	Aquifoliaceae
Portulacaceae	Brassicaceae	Gentianaceae	Apiaceae	Loganiaceae	Berberidaceae
Ranunculaceae	Crassulaceae	Hippocastanaceae	Apocynaceae	Magnoliaceae	Calycanthaceae
Saxifragaceae	Ericaceae	Magnoliaceae	Araliaceae	Malvaceae	Gentianaceae
	Gentianaceae	Onagraceae	Bignoniaceae	Oxalidaceae	Magnoliaceae
	Magnoliaceae	Ranunculaceae	Boraginaceae	Papaveraceae	Onagraceae
	Oleaceae	Saxifragaceae	Boraginaceae	Papaveraceae	Papaveraceae
	Onagraceae		Campanulaceae	Polemoniaceae	Ranunculaceae
	Portulacaceae		Caprifoliaceae	Ranunculaceae	
	Ranunculaceae		Caryophyllaceae	Rosaceae	
	Rubiaceae		Celastraceae	Rubiaceae	
	Saxifragaceae		Crassulaceae	Saxifragaceae	
	Scrophulariaceae		Diapensiaceae	Scrophulariaceae	
			Ericaceae	Staphyleaceae	
			Fabaceae	Styracaceae	
			Gentianaceae	Symplocaceae	
			Geraniaceae	Violaceae	
			Hydrophyllaceae		

<sup>a</sup> Sedge bristles, grass lodicules, spurge cyathia, and composite pappus should not be considered perianth parts.

TABLE 14. Stamen number character table. 0 = female flowers.

0	1	2	3	4
Aquifoliaceae	Araceae	Araceae	Araceae	Araceae
Araceae	Euphorbiaceae	Cyperaceae	Caryophyllaceae	Aquifoliaceae
Asteraceae		Orchidaceae	Commelinaceae	Betulaceae
Betulaceae		Poaceae	Cyperaceae	Elaeagnaceae
Crassulaceae		Bignoniaceae	Iridaceae	Gentianaceae
Cyperaceae		Salicaceae	Orchidaceae	Lamiaceae
Dioscoreaceae		Scrophulariaceae	Poaceae	Onagraceae
Euphorbiaceae			Valerianaceae	Plantaginaceae
Hydrophyllaceae				Rubiaceae
Lauraceae				Santalaceae
Oleaceae				Scrophulariaceae

Table 14 continues on next page

TABLE 14 (continued). Stamen number character table.

5	6	7	8	9	10	> 10
Apiaceae	Amaryllidaceae	Ericaceae	Crassulaceae	Lauraceae	Caryophyllaceae	Annonaceae
Aquifoliaceae	Araceae	Hippocastanaceae	Ericaceae		Celastraceae	Aristolochiaceae
Apocynaceae	Commelinaceae	Saururaceae	Onagraceae		Crassulaceae	Berberidaceae
Araliaceae	Dioscoreaceae		Portulacaceae		Ericaceae	Calycanthaceae
Asteraceae	Juncaceae		Thymeleaceae		Fabaceae	Malvaceae
Boraginaceae	Liliaceae				Geraniaceae	Magnoliaceae
Campanulaceae	Brassicaceae				Oxalidaceae	Papaveraceae
Caprifoliaceae	Fumariaceae				Portulacaceae	Ranunculaceae
Caryophyllaceae	Hippocastanaceae				Saxifragaceae	Rosaceae
Ericaceae	Polygonaceae				Styracaceae	Symplocaceae
Geraniaceae	Saururaceae					
Hydrophyllaceae						
Loganiaceae						
Polemoniaceae						
Polygonaceae						
(Portulacaceae						
Rhamnaceae						
Rubiaceae						
Santalaceae						
Saururaceae						
Saxifragaceae						
Staphyleaceae						
Violaceae						

TABLE 15. Perianth adnation character table.

<i>Present</i>			<i>Absent</i>		<i>Not applicable</i> (perianth lacking)
Amaryllidaceae	Fabaceae	Polemoniaceae	Annonaceae	Magnoliaceae	Araceae
Apocynaceae	Fumariaceae	Portulacaceae	Apiaceae	Malvaceae	Betulaceae
Aquifoliaceae	Gentianaceae	Ranunculaceae	Araceae	Oxalidaceae	Cyperaceae
Aristolochiaceae	Hippocastanaceae	Rhamnaceae	Araliaceae	Papaveraceae	Euphorbiaceae
Asteraceae	Hydrophyllaceae	Rosaceae	Berberidaceae	Polygonaceae	Oleaceae
Betulaceae	Iridaceae	Rubiaceae	Betulaceae	Ranunculaceae	Poaceae
Bignoniaceae	Lamiaceae	Santalaceae	Brassicaceae	Rosaceae	Salicaceae
Boraginaceae	Liliaceae	Saxifragaceae	Calycanthaceae	Symplocaceae	Saururaceae
Campanulaceae	Loganiaceae	Scrophulariaceae	Caryophyllaceae	Violaceae	
Caprifoliaceae	Malvaceae	Staphyleaceae	Comelinaceae		
Celastraceae	Oleaceae	Styracaceae	Crassulaceae		
Diapensiaceae	Onagraceae	Thymeleaceae	Geraniaceae		
Dioscoreaceae	Orchidaceae	Valerianaceae	Juncaceae		
Elaeagnaceae	Oxalidaceae		Lauraceae		
Ericaceae	Plantaginaceae		Liliaceae		

TABLE 16. Leaf type character table.

## SIMPLE

*Unlobed*

Amaryllidaceae	Commelinaceae	Liliaceae
Annonaceae	Crassulaceae	Loganiaceae
Apiaceae	Cyperaceae	Magnoliaceae
Apocynaceae	Diapensiaceae	Malvaceae
Araceae	Dioscoreaceae	Oleaceae
Aristolochiaceae	Elaeagnaceae	Onagraceae
Asteraceae	Ericaceae	Orchidaceae
Betulaceae	Euphorbiaceae	Oxalidaceae
Boraginaceae	Fabaceae	Plantaginaceae
Brassicaceae	Gentianaceae	Poaceae
Calycanthaceae	Hydrophyllaceae	Polemoniaceae
Campanulaceae	Iridaceae	Polygonaceae
Caprifoliaceae	Juncaceae	Portulacaceae
Caryophyllaceae	Lamiaceae	Ranunculaceae
Celastraceae	Lauraceae	Rhamnaceae

*Lobed*

Rosaceae	Apocynaceae
Rubiaceae	Aquifoliaceae
Salicaceae	Araceae
Santalaceae	Aristolochiaceae
Saururaceae	Asteraceae
Saxifragaceae	Berberidaceae
Scrophulariaceae	Brassicaceae
Styracaceae	Caprifoliaceae
Symplocaceae	Geraniaceae
Thymeleaceae	Lauraceae
Valerianaceae	Papaveraceae
Violaceae	Saxifragaceae
	Scrophulariaceae
	Violaceae

*Dissected*

Apiaceae
Brassicaceae
Fumariaceae
Geraniaceae
Ranunculaceae

## COMPOUND

*Trifoliolate*

Araceae
Brassicaceae
Fabaceae
Oxalidaceae
Ranunculaceae
Rosaceae
Staphyleaceae

*Decompound/Dissected*

Apiaceae
Fumariaceae
Geraniaceae
Hydrophyllaceae
Ranunculaceae
Rosaceae

*Pinnate*

Apiaceae
Araliaceae
Bignoniaceae
Brassicaceae
Caprifoliaceae
Fabaceae
Fumariaceae
Geraniaceae
Hydrophyllaceae
Ranunculaceae
Rosaceae

*Palmate*

Hippocastanaceae
Rosaceae

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