THE PHYLOGENY OF TRIMERY IN ANGIOSPERMS FLOWERS

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(Received October 12, 1965)

In the angiosperms, the number of the various floral parts is usually recognized as typically trimerous in the monocotyledons and tetramerous or pentamerous in the dicotyledons. In the latter, the number is sometimes indefinite in certain groups while in others, it may be trimerous at least in some parts of the flowers.

Spiral arrangement, together with indefinite number in the floral parts, is now generally considered to represent the most primitive condition in the flowering plants. Some phylogenists also regard the monocotyledons as a more advanced group than the dicotyledons. It thus might be inferred that trimery represents an advanced condition.

Schellenberg (1928), however, considered trimery in the monocotyledons to be a primitive feature. The present writer (Li, 1960) pointed out the prevalence of trimery in the flowers of the more primitive families of the dicotyledons such as the Annonaceae, Myristicaceae, Lauraceae, Berberidaceae and Menispermaceae. Thorne (1963) in a discussion on angiosperm phylogeny mentioned trimery in certain dicotyledonous families also as a primitive characteristic. The present paper is a study of this feature in the angiosperms as a whole, with an attempt to evaluate its significance in phylogeny.

Hutchinson's recent work (Hutchinson, 1959) is used as the basis for analysis. This work is chosen because it is the latest complete survey of the families of flowering plants and the descriptions of the families given therein furnish more or less complete information for the purpose. Only in a few cases are supplementary information from other sources necessary. Hutchinson's recognition of many monotypic families and small orders and his division of the dicotyledons into two basic groups the Lignosae and Herbaceae are not favored or supported by all taxonomists. The use of his scheme, however, does not detract from the purpose of this analysis. Also, the results presented herein may serve instead to check the validity of his dichotomous system for the dicotyledons.

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The characteristic of trimery in each of the four kinds of floral parts for all families, defined and arranged according to the Hutchinson system, is recorded in the following list. Each family name is followed by four places representing calyx, corolla, androecium, and gynoecium respectively. The number 3 in bold face type (**3**) represents definite and uniform trimery, that is, when the particular floral part is 3 or multiples of 3 in the family. For the gynoecium, this may be indicated by 3 carpels, a 3-celled ovary, 3 placentae, or 3 styles or stigmas. The mumber 3 in regular type (3) represents the presence of a trace of trimery as indicated by the occurrence, either common or rare, throughout the family of 3 or multiples of 3 in a floral part with a variable number. For numbers other than 3 or multiples of 3 or variable numbers without traces of trimery, the dash sign (—) is used. As it is the family characteristic and not individual plants that are being considered, the absence of either androecium or gynoecium in unisexual flowers is disregarded. In the monocotyledons, the perianth is sometimes not differentiable into calyx and corolla. In these cases, the outer series is considered, for our purpose, as calyx and the inner as corolla. This is actually a matter of little consequence as in all cases, in monocotyledons as well as dicotyledons, the basic number for the outer and inner perianth is always the same.

List of families showing trimery in floral parts

(arranged according to the Hutchinson system)

Dicotyledonae

DIVISION LIGNOSAE

1. Magnoliales

1. Magnoliaceae	3 – – –
2. Illiciaceae	– – – 3
3. Winteraceae	3 – – –
4. Canellaceae	– – – –
5. Schisandraceae	3 3 – –
6. Himantandraceae	– – – –
7. Lactoridaceae	**3 0 3 3**
8. Trochodendraceae	0 0 – 3
9. Cercidiphyllaceae	– 0 3 3

2. Annonales

10. Annonaceae	**3 3** – –
11. Eupomatiaceae	– – – –

3. Laurales

12. Monimiaceae	– – – –
13. Austrobaileyaceae	3 3 – –
14. Trimeniaceae	3 0 – 3
15. Lauraceae	**3 3 3** –
16. Gomortegaceae	3 0 – 3
17. Hernandiaceae	3 3 3 –
18. Myristicaceae	**3** 0 – –

4. Dilleniales

19. Dilleniaceae	– – – –
20. Connaraceae	– – – –
21. Crossosomataceae	– – – 3
22. Brunelliaceae	– 0 – –

5. Coriariales

23. Coriariaceae	– – – –

6. Rosales

24. Rosaceae	– – – –
25. Chailletiaceae	– – – 3

26. Calycanthaceae	– – – –
7. Leguminales	
27. Caesalpiniaceae	– – – –
28. Mimosaceae	– – – –
29. Papilionaceae	– – – –
8. Cunoniales	
30. Pterostemonaceae	– – – –
31. Cunoniaceae	3 3 – –
32. Philadelphaceae	– – – –
33. Hydrangeaceae	– – – 3
34. Grossulariaceae	– – – –
35. Oliniaceae	– – – 3
36. Greyiaceae	– – – –
37. Escalloniaceae	– – 3 3
38. Baueraceae	– – – –
39. Crypteroniaceae	– – – –
9. Styracales	
40. Lissocarpaceae	– – – –
41. Styracaceae	– – – 3
42. Symplocaceae	– – – –
10. Araliales	
43. Cornaceae	– – – –
44. Alangiaceae	– – – –
45. Garryaceae	– – – –
46. Nyssaceae	– – – –
47. Araliaceae	– – – –
48. Caprifoliaceae	– – – –
11. Hamamelidales	
49. Tetracentraceae	– – – –
50. Hamamelidaceae	– – – –
51. Myrothamnaceae	0 0 – **3**
52. Platanaceae	0 0 – –
53. Stachyuraceae	– – – –
54. Buxaceae	– – 3 **3**
55. Daphniphyllaceae	3 0 3 –
56. Bruniaceae	– – – –
12. Salicacales	
57. Salicaceae	0 0 – –
13. Leitneriales	
58. Leitneriaceae	0 0 3 1
14. Myricales	
59. Myricaceae	0 0 – –
15. Balanopsidales	
60. Balanopsidaceae	0 0 3 3
16. Fagales	
61. Betulaceae	– 0 – –
62. Fagaceae	3 0 – 3
63. Corylaceae	– 0 – –
17. Juglandales	
64. Rhoipteleaceae	– 0 3 –
65. Juglandaceae	3 0 3 –
66. Picrodendraceae	0 0 – –
18. Casuarinales	
67. Casuarinaceae	0 0 – –
19. Urticaceae	
68. Ulmaceae	– 0 – –
69. Cannabiaceae	– 0 – –
70. Moraceae	– 0 – –
71. Urticaceae	– 0 – –
72. Barbeyaceae	3 0 3 –
73. Eucommiaceae	0 0 – –
20. Bixales	
74. Bixaceae	– – – –
75. Cistaceae	3 – – –
76. Flacourtiaceae	– – – –
77. Cochlospermaceae	– – – 3
78. Hoplestigmataceae	– – – –
79. Achatocarpaceae	– 0 – –
80. Lacistemaceae	3 0 – 3
21. Thymelaeales	
81. Gonostylaceae	– – – 3
82. Aquilariaceae	– – – –
83. Geissolomataceae	– 0 – –
84. Penaeaceae	– 0 – –
85. Thymelaeaceae	– – – –
86. Nyctaginaceae	– 0 – –
22. Proteales	
87. Proteaceae	– 0 – –
23. Pittosporales	
88. Pittosporaceae	– – – –

89. Byblidaceae	– – – 3
90. Stegnospermaceae	– – – 3
91. Vivianiaceae	– – – 3
92. Tremandraceae	3 3 – 3
24. Capparidales	
93. Capparidaceae	– – – –
94. Moringaceae	– – – 3
95. Tovariaceae	– – – 3
25. Tamaricales	
96. Frankeniaceae	3 3 3 3
97. Tamaricaceae	3 3 – 3
98. Fouquieriaceae	– – – 3
26. Violales	
99. Violaceae	– – – 3
27. Polygalales	
100. Polyglaceae	– 3 – 3
101. Krameriaceae	– – 3 –
102. Trigoniaceae	– 3 – 3
103. Vochysiaceae	– – – 3
28. Loasales	
104. Turneraceae	– – – 3
105. Loasaceae	– – – 3
29. Passiflorales	
106. Malesherbiaceae	– – – 3
107. Passifloraceae	– – – 3
108. Achariaceae	3 3 3 3
30. Cucrurbitales	
109. Cucurbitaceae	– – 3 3
110. Begoniaceae	– – – –
111. Datiscaceae	3 – – –
112. Caricaceae	– – – –
31. Cactales	
113. Cactaceae	– – – 3
32. Tiliales	
114. Dirachmaceae	– – – –
115. Scytopetalaceae	– 3 – 3
116. Tiliaceae	– – – –
117. Sterculiaceae	3 – – –
118. Peridiscaceae	– 0 – 3
119. Bombacaceae	– – – –
33. Malvales	
120. Malvaceae	3 – – –
34. Malpighiales	
121. Ixonanthaceae	– – – 3
122. Malpighiaceae	– – – 3
123. Humiriaceae	– – – –
124. Linaceae	– – – 3
125. Irvingiaceae	– – – –
126. Huaceae	3 – – –
127. Ledocarpaceae	– – – 3
128. Erythroxylaceae	– – – **3**
129. Ctenolophonaceae	– – – –
130. Lepidobotryaceae	– – – 3
131. Balanitaceae	– – – –
132. Zygophyllaceae	– – – –
35. Euphorbiales	
133. Euphorbiaceae	– – 3 **3**
36. Theales	
134. Bonnetiaceae	– – – 3
135. Theaceae	– – – 3
136. Saurauiaceae	– – – 3
137. Actinidiaceae	– – – 3
138. Pellicieraceae	– – – –
139. Pentaphylacaceae	– – – –
140. Tetrameristaceae	– – – –
141. Marcgraviaceae	– – 3 –
142. Caryocaraceae	3 3 – –
143. Medusagynaceae	– – – –
37. Ochnales	
144. Strasburgeriaceae	– – – –
145. Ochnaceae	– – – –
146. Sarcolaenaceae	**3** 3 – **3**
147. Sphaerosepalaceae	– – – –
148. Dipterocarpaceae	– – – **3**
149. Ancistrocladaceae	– – – 3
38. Ericales	
150. Clethraceae	– – – **3**
151. Pyrolaceae	– – – –
152. Ericaceae	– – – –
153. Epacridaceae	– – – –

154. Diapensiaceae	– – – **3**
155. Monotropaceae	3 3 3 3
156. Lennoaceae	3 – – 3
157. Vaccinicaceae	– – – –
39. Guttiferales	
158. Hypericaceae	– – – 3
159. Clusiaceae	3 3 – –
160. Eucryphiaceae	– – – –
161. Quiinaceae	– – 3 3
40. Myrtales	
162. Myrtaceae	3 – – –
163. Lecythidaceae	3 3 – –
164. Rhizophoraceae	3 – – 3
165. Sonneratiaceae	– – – –
166. Punicaceae	– – – –
167. Combretaceae	– – – –
168. Melastomataceae	– – – –
41. Celastrales	
169. Pandaceae	– – – 3
170. Aquifoliaceae	– – – 3
171. Salvadoraceae	3 – – –
172. Koeberliniaceae	– – – –
173. Cneoraceae	3 3 3 3
174. Cardiopteridaceae	– – – –
175. Cyrillaceae	– – – 3
176. Icacinaceae	– – – 3
177. Empetraceae	3 – – 3
178. Aextoxicaceae	– – – –
179. Pentadiplandraceae	– – – 3
180. Celastraceae	– – – –
181. Corynocarpaceae	– – – –
182. Stackhousiaceae	– – – –
183. Goupiaceae	– – – 3
184. Hippocrateaceae	– – **3 3**
185. Erythropalaceae	– – – 3
186. Capusiaceae	– – – –
187. Scyphostegiaceae	3 **3 3** 3
42. Olacales	
188. Olacaceae	3 3 3 3
189. Opiliaceae	– – – –
190. Octoknemaceae	– – – 3
191. Aptandraceae	– – – –
192. Dipentodontaceae	– – – –
193. Medusandraceae	– – – 3
43. Santalales	
194. Loranthaceae	3 3 3 3
195. Grubbiaceae	– – – –
196. Santalaceae	**3** 0 – –
197. Myzodendraceae	– 0 – 3
198. Balanophoraceae	3 3 3 3
44. Rhamnales	
199. Heteropyxidaceae	– – – 3
200. Elaeagnaceae	– 0 – –
201. Rhamnaceae	– – – –
202. Vitaceae	– – – 3
45. Myrsinales	
203. Myrsinaceae	3 3 – 3
204. Theophrastaceae	– – – –
205. Aegiceratacaceae	– – – –
46. Ebenales	
206. Ebenaceae	3 – – 3
207. Sapotaceae	– – – –
208. Sarcospermaceae	– – – –
47. Rutales	
209. Rutaceae	– – – –
210. Simaroubaceae	3 3 3 –
211. Burseraceae	3 3 3 –
212. Averrhoaceae	– – – –
48. Meliales	
213. Meliaceae	– – – –
49. Sapindales	
214. Melianthaceae	– – – –
215. Sapindaceae	– – – 3
216. Podoaceae	– – – –
217. Sabiaceae	– – – 3
218. Anacardiaceae	– 3 – 3
219. Aceraceae	– – – 3
220. Hippocastanaceae	– – – 3
221. Staphyleaceae	– – – 3
222. Akaniaceae	– – – 3

223. Julianiaceae	3 0 3 3
224. Didiereaceae	– – – 3
50. Loganiales	
225. Potaliaceae	– – – –
226. Loganiaceae	– – – 3
227. Buddleiaceae	– – – –
228. Antoniaceae	– – – –
229. Spigeliaceae	– – – –
230. Strychnaceae	– – – –
231. Oleaceae	– – – –
51. Apocynales	
232. Plocospermaceae	3 3 3 –
233. Apocynaceae	– – – –
234. Peripiocaceae	– – – –
235. Asclepiadaceae	– – – –
52. Rubiales	
236. Dialypetalanthaceae	– – – –
237. Rubiaceae	– – – –
53. Bignoniales	
238. Cobaeaceae	– – – **3**
239. Bignoniaceae	– – – –
240. Pedaliaceae	– – – –
241. Martyniaceae	– – – –
54. Verbenales	
242. Ehretiaceae	– – – –
243. Verbenaceae	– – – –
244. Stilbeaceae	– – – –
245. Chloanthaceae	– – – –
246. Phrymaceae	– – – –
DIVISION HERBACEAE	
55. Ranales	
247. Paeoniaceae	– – – 3
248. Helleboraceae	3 – – –
249. Ranunculaceae	– – – –
250. Nymphaeaceae	3 – – –
251. Podophyllaceae	3 **3** **3** –
252. Ceratophyllaceae	– 0 – –
253. Cabombaceae	3 3 3 3
56. Berberidales	
254. Sargentodoxaceae	**3** **3** **3** –
255. Lardizabalaceae	**3** **3** **3** **3**
256. Menispermaceae	**3** **3** **3** **3**
257. Nandinaceae	– **3** **3** –
258. Circaeasteraceae	– 0 – –
259. Berberidaceae	**3** **3** **3** 3
57. Aristolochiales	
260. Aristolochiaceae	3 0 3 3
261. Hydnoraceae	3 0 – –
262. Cytinaceae	– 0 – –
263. Nepenthaceae	3 0 3 3
58. Piperales	
264. Piperaceae	0 0 3 –
265. Saururaceae	0 0 3 3
266. Chloranthaceae	3 0 3 –
59. Rhoeadales	
267. Papaveraceae	3 3 – –
268. Fumariaceae	– – – –
60. Cruciales	
269. Cruciferae	– – 3 –
61. Resedales	
270. Resedaceae	– – 3 3
62. Caryophyllales	
271. Elatinaceae	3 3 3 3
272. Molluginaceae	– – – –
273. Caryophyllaceae	– – – 3
274. Ficoidaceae	– – – –
275. Portulacaceae	– 3 – –
63. Polygonales	
276. Polygonaceae	3 0 **3** 3
277. Illecebraceae	– – – 3
64. Chenopodiales	
278. Barbeuiaceae	– 0 – –
279. Phytolaccaceae	– – – –
280. Gyrostemonaceae	– 0 3 –
281. Agdestidaceae	– 0 – 3
282. Petiveriaceae	– – – –
283. Chenopodiaceae	3 0 3 3
284. Amaranthaceae	3 0 – 3
285. Cynocrambaceae	– – – –
286. Batidaceae	– – – –

287. Basellaceae	- - - -
65. Lythrales	
288. Lythraceae	- - - 3
289. Onagraceae	- - - 3
290. Trapaceae	- - - -
291. Halorrhagaceae	- - - -
292. Callitrichaceae	0 0 - -
66. Gentianales	
293. Gentianaceae	- - - -
294. Menyanthaceae	- - - -
67. Primulales	
295. Primulaceae	- - - -
296. Plumbaginaceae	- - - -
68. Plantaginales	- - - -
297. Plantaginaceae	- 3 - -
69. Saxifragales	
298. Crassulaceae	- - - -
299. Cephalotaceae	**3** 0 3 **3**
300. Saxifragaceae	- - - 3
301. Eremosynaceae	- - - -
302. Vahliaceae	- - - 3
303. Francoaceae	- - - -
304. Donatiaceae	- - 3 3
305. Parnassiaceae	- - - -
306. Adoxaceae	3 3 3 3
70. Sarraceniales	
307. Droseraceae	- - - 3
308. Sarraceniaceae	- - - 3
71. Podostemales	
309. Podostemaceae	3 0 - 3
310. Hydrostachyaceae	0 0 - -
72. Umbellales	
311. Umbelliferae	- - - -
73. Valerianales	
312. Valerianaceae	- - - 3
313. Dipsacaceae	- - - -
314. Calyceraceae	3 3 3 -
74. Campanales	
315. Campanulaceae	3 - - -
316. Lobeliaceae	- - - 3
75. Goodeniales	
317. Goodeniaceae	- - - -
318. Brunoniaceae	- - - -
319. Stylidiaceae	- - - -
76. Asterales	
320. Compositae	- - - -
77. Solanales	
321. Solanaceae	3 - - -
322. Convolvulaceae	- - - 3
323. Nolanaceae	- - - -
78. Personales	
324. Scrophulariaceae	- - - -
325. Acanthaceae	- - - -
326. Gesneriaceae	- - - -
327. Orobanchaceae	- - - -
328. Lentibulariaceae	- - - -
329. Columelliaceae	- - - -
79. Geraniales	
330. Geraniaceae	- - - 3
331. Limnanthaceae	3 3 3 3
332. Oxalidaceae	- - - -
333. Tropaeolaceae	- - - -
334. Balsaminaceae	3 - - -
80. Polemoniales	
335. Polemoniaceae	- - - 3
336. Hydrophyllaceae	- - - -
337. Cuscutaceae	- - - -
81. Boraginales	
338. Boraginaceae	- - - -
82. Lamiales	
339. Myoporaceae	- - - -
340. Selaginaceae	- - - -
341. Globulariaceae	- - - -
342. Labiatae	- - - -

Monoctyledonae

83. Butomales	
343. Butomaceae	**3 3** 3 3
344. Hydrocharitaceae	3 3 3 **3**
84. Alismatales	

345. Alismataceae	**3 3 3 3**
346. Scheuchzeriaceae	**3 3 3 3**
347. Petrosaviaceae	**3 3 3 3**
85. Triuridales	
348. Triuridaceae	3 3 **3** 3
86. Juncaginales	
349. Juncaginaceae	**3 3** 3 3
350. Lilaeaceae	3 3 3 3
351. Posidoniaceae	**3 3** 3 3
87. Aponogetonales	
352. Aponogetonaceae	3 3 **3 3**
353. Zosteraceae	3 3 3 –
88. Potamogetonales	
354. Potamogetonaceae	– – – –
355. Ruppiaceae	0 0 – –
89. Najadales	
356. Zannichelliaceae	**3 3** 3 3
357. Najadaceae	3 3 3 –
90. Commelinales	
358. Commelinaceae	**3 3 3 3**
359. Cartonemataceae	**3 3 3 3**
360. Flagellariaceae	**3 3 3 3**
361. Mayacaceae	**3 3 3 3**
91. Xyridales	
362. Xyridaceae	**3 3 3 3**
363. Rapateaceae	**3 3 3 3**
92. Eriocaulales	
364. Eriocaulaceae	3 3 3 3
93. Bromeliales	
365. Bromeliaceae	**3 3 3 3**
94. Zingiberales	
366. Musaceae	**3 3 3 3**
367. Strelitziaceae	**3 3 3 3**
368. Lowiaceae	**3 3** 3 **3**
369. Zingiberaceae	**3 3** 3 **3**
370. Cannaceae	**3 3 3 3**
371. Marantaceae	**3 3 3 3**
95. Liliales	
372. Liliaceae	**3 3 3 3**
373. Tecophilaeaceae	**3 3 3 3**
374. Trilliaceae	**3 3 3 3**
375. Pontederiaceae	**3 3 3 3**
376. Smilacaceae	**3 3 3 3**
377. Ruscaceae	**3 3 3 3**
96. Alstroemeriales	
378. Alstroemeriaceae	**3 3 3 3**
379. Petermanniaceae	**3 3 3 3**
380. Philesiaceae	**3 3 3 3**
97. Arales	
381. Araceae	3 3 3 3
382. Lemnaceae	0 0 – –
98. Typhales	
383. Sparganiaceae	– – 3 –
384. Typhaceae	– – – –
99. Amaryllidales	
385. Amaryllidaceae	**3 3 3 3**
100. Iridales	
386. Iridaceae	**3 3 3 3**
101. Dioscoreales	
387. Stenomeridaceae	**3 3 3 3**
388. Trichopodaceae	**3 3 3 3**
389. Roxburghiaceae	– – – –
390. Dioscoreaceae	**3 3 3 3**
102. Agavales	
391. Xanthorrhoeaceae	**3 3 3 3**
392. Agavaceae	**3 3 3 3**
103. Palmales	
393. Palmae	**3 3 3 3**
104. Pandanales	
394. Pandanaceae	0 0 – –
105. Cyclanthales	
395. Cyclanthaceae	– – – –
106. Haemodorales	
396. Haemodoraceae	**3 3 3 3**
397. Hypoxidaceae	**3 3 3 3**
398. Velloziaceae	**3 3 3 3**
399. Apostasiaceae	**3 3 3 3**
400. Taccaceae	**3 3 3 3**
401. Philydraceae	– – – **3**
107. Burmanniales	

402. Burmanniaceae	**3 3 3 3**	407. Thurniaceae	**3 3 3 3**
403. Thismiaceae	**3 3 3 3**	408. Centrolepidaceae	0 0 – 3
404. Corsiaceae	**3 3 3** –	409. Restionaceae	**3 3 3 3**
108. Orchidales		*110. Cyperales*	
405. Orchidaceae	**3 3** – **3**	410. Cyperaceae	– – **3** 3
109. Juncales		*111. Graminales*	
406. Juncaceae	**3 3 3 3**	411. Gramineae	3 3 3 3

Summary of figures

The following tables give an overall summary of the enumeration and figures presented above.

I. Dicotyledons—342 families

Floral parts / No. of parts	Calyx	Corolla	Androecium	Gynoecium
Trimery	13	9	10	15
Trace of trimery	60	32	43	110
Absence	14	57	—	—
Other numbers	255	244	289	217
Total for trimery	73	41	53	125
Percentage	21%	12%	15%	37%

II. Monocotyledons—69 families

Floral parts / No. of parts	Calyx	Corolla	Androecium	Gynoecium
Trimery	49	49	45	47
Trace of trimery	9	9	14	11
Absence	4	4	—	—
Other numbers	7	7	10	11
Total for trimery	58	58	59	58
Percentage	84%	84%	85%	84%

General Observations

From the above survey, several items are noted:

(1) In the dicotyledons, trimery in floral parts is a relatively common and wide-spread feature. As many as 35% of the families have indications of trimery in some cycles of their flowers. About 12% of the families have predominently trimerous flowers.

(2) Although trimery in floral parts is generally recognized as a major distinctive characteristic of the monocotyledons as a whole, no less than 14–15% of the families have no trimery or only partial trimery in some or all parts of their flowers. Trimery is completely absent in seven out of the total 69 families; the seven are Potamogetonaceae, Ruppiaceae, Lemnaceae, Typhaceae, Roxburghiaceae, Pandanaceae, Cyclanthaceae. These range from relatively primitive to highly specialized families and from familes adapted in general to relatively dry situations to completely aquatic habitats.

(3) In the dicotyledons, a distinct concentration of trimery is found among those families generally considered as the more primitive or the most primitive, such as Schisandraceae, Lactoridaceae, Cercidiphyllaceae, Austrobaileyaceae, Trimeniaceae, Lauraceae, Gomortegaceae, Hernandaceae, Podophyllaceae, Cabombaceae, Sargentodoxaceae, Lardizabalaceae, Menispermaceae, Berberidaceae, and Aristolochiaceae. From two-third to nearly all of the families in the primitive orders Magnoliales, Laurales, Ranales, Berberidales, Aristolochiales and Piperales are either predominantly or distinctively trimerous.

(4) The more primitive families with trimerous flowers are almost equally distributed in the Lignosae and Herbaceae series of Hutchinson. This does not seem to give any support to such a dichotomous division of the diocotyledon phylogeny.

(5) Trimery gradually diminishes in importance in orders and families along the phylogenetic scale and becomes completely absent in orders generally considered as the most specialized or advanced. In the Hutchinson system, the following orders contain no trace of trimery:

Araliales (Cornaceae, Alangiaceae, Garryaceae, Nyssaceae, Araliaceae, Caprifoliaceae).

Rubiales (Dialypetalanthaceae, Rubiaceae).

Verbenales (Ehretiaceae, Verbenaceae, Stilbeaceae, Phrymaceae).

Umbellales (Umbelliferae).

Goodeniales (Goodeniaceae, Brunoniaceae, Stylidaceae).

Asterales (Compositae).

Personales (Scrophulariaceae, Acanthaceae, Gesneriaceae, Orobanchaceae, Lentibulariaceae, Columelliaceae).

Lamiales (Myoporaceae, Selaginaceae, Globulariaceae, Labiatae).

In other highly advanced orders, such as Loganiales, Bignoniales, Solanales and Polemoniales, trimery is also nearly completely absent.

(6) In summary, trimery in floral parts appears to be a primitive feature in the angiosperms. It remains prevalent in the monocotyledons. In the dicotyledons it persists largely among the more primitive families, diminishes in importance gradually along the phylogenetic scale, and finally disappears completely among the most advanced orders and families.

Literature cited

HUTCHINSON, J. The Families of Flowering Plants. 2 vols. Oxford, 1959.

LI, H. L. A theory on the ancestry of angiosperms. Acta Biotheoretica **13**: 185-202, 1860.

SCHELLENBERG, G. Beiträge zu einem phylogenetischen System der Blütenpflanzen. Beibl. Viert. naturf. Ges. Zürich, **73**: 355-381, 1928.

THORNE, R. F. Some problems and guiding principles of angiosperm phylogeny. Amer. Naturalist, **97**: 287-305, 1963.