

2 Book review

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4 **Plant Systematics: A Phylogenetic Approach, 3rd edn.** By
5 Judd, W. S., Campbell, C. S., Kellogg, E. A., Stevens, P.
6 F., Donoghue, M. J., Sinauer Associates Inc., Sunder-
7 land, MA. Hardback, ISSN 978-0-87893-407-2, 2007,
8 \$94.59, 611 pp.

9 In August of 2007 Sinauer Associates released the
10 third edition of *Plant Systematics: A Phylogenetic*
11 *Approach* by Judd *et al.* Compiled by five authors, each
12 an expert in complementary aspects of plant systematics,
13 the book builds from the 1999 Engler Award-winning
14 first edition and continues to target undergraduates in
15 plant systematic biology courses. In many areas the text
16 and examples go beyond the coverage likely to be
17 incorporated in the average undergraduate class and
18 ultimately this represents a valuable resource for the
19 graduate student and practising plant systematist. This
20 review will provide a basic outline of the topics covered
21 in the book, updates relative to the second edition, my
22 perception of its strengths and weaknesses, and a
23 discussion of how the text compares with the currently
24 available competition in the undergraduate plant sys-
25 tematics textbook market.

26 The book's nine chapters and two appendices lead the
27 reader from the fundamentals of systematic biology
28 through an in-depth treatment of the angiosperm
29 branch of the Tracheophyta. The overview of the basic
30 concepts and importance of plant systematic biology in
31 Chapter 1 establishes the fundamental role of modern
32 phylogenetics in classification, nomenclature, biogeog-
33 raphy, evolutionary biology, ecological diversification,
34 and ethnobotany. In the last section of the chapter the
35 authors also provide a useful overview of the book's
36 organization to help the reader.

37 Chapter 2 delves deeper into the principles and
38 methods of modern systematic biology. This begins
39 with coverage of heritable character data, moves on to
40 the inference of trees, and continues with a discussion of
41 outgroups, tree selection, homoplasy, and basic metrics
42 by which trees are compared and clade support assessed.
43 The chapter ends with the connection between phylog-
44 eny and classification. Although readers of *Cladistics*
45 may not find the chapter sufficient, the authors have
46 succeeded in presenting most of the basic material at the
47 undergraduate level. In addition, ample literature cita-
48 tions direct the interested student to further reading.

The discussion of the history of plant systematics and 49
systematic biology in Chapter 3 is a pleasure to read and 50
ultimately covers the people and developments in a 51
useful and interesting manner. Coverage includes an 52
historical consideration of classification, stability, the 53
development of phylogenetic inference, and alternative 54
classifications through time. 55

Chapters 4 and 5 provide a discussion of alternative 56
classes of character data. The former begins with an 57
extremely useful illustrated glossary of plant morphol- 58
ogy followed by discussion of pollination syndromes. 59
A series of short sections focused on inflorescence 60
structure, fruit types, anatomy, cytology, embryology, 61
palynology, and secondary metabolites follows. 62
Although some coverage of the latter topics is brief, 63
the literature cited provides additional direction for 64
further reading. Overall, the illustrations, text boxes, 65
and descriptions in Chapter 4 represent a tremendously 66
useful resource for the student of plant systematics. 67

Issues relating to molecular character data are 68
reserved for Chapter 5. This discussion provides a 69
strong introduction to DNA sequence data, specific 70
issues relating to the three plant genomes, and com- 71
monly applied loci in plant systematics. Coverage of 72
phylogenetic analysis of molecular data (e.g. alignment, 73
models, gene-trees/species-trees) is mostly sufficient for 74
the undergraduate introduction, but they are inadequate 75
as a useful long-term reference for the owner. 76

In my view, the unique strengths of the book begin to 77
reveal themselves with Chapter 6, "The Evolution of 78
Plant Diversity". This segment provides an excellent 79
"short course" on the mechanisms and driving forces 80
commonly discussed in plant evolutionary biology. 81
Relevant coverage of the importance of hybridization, 82
introgression, and polyploidization are well supported 83
with interesting examples and carefully conceived fig- 84
ures. 85

The bulk of what follows, nearly 400 pages in 86
Chapters 7–9, includes coverage of Tracheophyta phy- 87
logenetics and characteristics of major groups down to 88
the level of family. This component includes keys, 89
explicit reference to over 170 families (*c.* 30 non- 90
angiosperm and 140 angiosperm), and discussion of 91
the number of genera/species, critical morphology, 92
economically important members, relevant literature, 93
and the relative support for inferred relationships. 94

95 Representing a monumental synthesis of information,
96 these chapters are the heart of the book. They not only
97 impart critical information but illustrate the application
98 and practice of modern systematic biology through the
99 discussion of phylogenetic studies and inferred evolu-
100 tionary patterns.

101 Those familiar with the previous editions of *Plant*
102 *Systematics: A Phylogenetic Approach* will immediately
103 notice the addition of colour throughout. By increasing
104 the number of colour figures and photographic plates
105 the authors and publisher have enhanced their ability to
106 convey information and the general aesthetic of the
107 book for a nominal increase in price. Numerous changes
108 and additions keep the reader abreast of developments
109 in our understanding of relationships (largely incorpo-
110 rated in Chapters 8 and 9) and, for example, the
111 availability of large numbers of complete plant genomes
112 for phylogenetic studies (Chapter 5). From the instruc-
113 tors point of view, the development of the “Instructor’s
114 Resources Library” CD (PowerPoint and JPG files for
115 all line art, photographic plates, and tables—available to
116 instructors on request) is extremely valuable. Further-
117 more, the “Photo Gallery” CD, introduced in the
118 second edition, has continued to grow (3100 images,
119 1900 spp., and 185 families) and represents an easy-to-
120 use resource for instructors and students augmenting
121 photo collections and study tools from those available
122 online (e.g. <http://www.plantsystematics.org>).

123 When considering the authors’ stated objectives, I was
124 hard-pressed to identify many significant problems or
125 disappointments. Of those, one specifically relating to
126 the interests of the readers of *Cladistics* is the coverage
127 of Hennig’s contributions to systematic biology. Attent-
128 ion to the issue of special similarity and its importance
129 to the development of phylogenetic theory are provided
130 in parts of the first three chapters, with the primary
131 focus on “Hennigian Argumentation” in Box 2A.
132 Unfortunately, this treatment is not as clear as it might
133 be. The pertinent topics and debates are introduced;
134 however, the uninitiated may overlook the essential
135 distinction in grouping information provided by special
136 similarity when compared with overall similarity. This is
137 particularly true in Box 2A, which discusses Hennig’s
138 development of the concept of synapomorphy, but the
139 topic is obscured by an initial focus on aspects of
140 rooting and polarity that Hennig addressed, but that are
141 unnecessary when attempting to illustrate Hennig’s
142 fundamental contributions that endure in modern
143 practice. A second concern was with the brief and
144 partial description of gene-trees and species-trees in
145 Chapter 5. The combination of incomplete coverage
146 (e.g. no discussion of orthology and paralogy) and the
147 use of a complicated example may lead to confusion
148 among students. In my view, these topics are sufficiently
149 fundamental in modern systematic biology to warrant
150 further clear discussion. Lastly, being written by a group

of experts comes with obvious benefits (see above) and a
151 few potential drawbacks. The only items worth noting in
152 this context are the presence of some minor inaccuracies
153 that are probably the result of individual authors
154 focusing on their own chapters and a bit less on
155 integration and consistency among chapters. An exam-
156 ple presents itself when comparing Fig. 1.1 and various
157 figures and discussion in Chapter 7. The evolution of
158 xylem and phloem is noted to have occurred within the
159 “bryophytes” in Fig. 1.1. However, the figures and
160 discussion in Chapter 7 clearly describe that “bryo-
161 phytes” are not considered to have homologous vascu-
162 lature to members of Tracheophyta. A few other
163 editorial issues have slipped through; those of us using
164 the text may wish to point out problems with Fig. 2.7
165 (autapomorphy inadvertently equated with synapomor-
166 phy), Fig. 2.21 (two different representations of the same
167 phenetic distances that are not equivalent), and an
168 inaccurate verbal definition of the retention index (p.
169 23). These are nitpicky details in an excellent text. 170

As part of this review it seemed useful to consider how
171 the third edition of this text measures up against the
172 available competition. To the best of my knowledge,
173 there are two primary competitors in the undergraduate
174 plant systematics textbook market—Walters, Keil, and
175 Murrell’s *Vascular Plant Taxonomy* and Michael Simp-
176 son’s *Plant Systematics*. When considering the topics
177 covered and relative clarity of each, I concluded that all
178 three are worth serious consideration. With regard to
179 the fundamental topics incorporated, each serves the
180 student and instructor well. Some discussion of each
181 book’s relative merits may help those seeking a new text
182 narrow in on the most appropriate option. 183

Having not previously examined Michael Simpson’s
184 *Plant Systematics* (Elsevier, 2006, MSRP \$72.95 but
185 available online for about \$60), I was extremely
186 impressed by the breadth of coverage, utility of figures,
187 general readability of the text, and reasonable price. The
188 coverage includes thorough introductory chapters on
189 plant systematics and systematic biology. These sections
190 are followed by a series of chapters encompassing plant
191 evolution. Here the treatment is especially detailed,
192 including aspects of life cycle and specifics of morphol-
193 ogy that few instructors would be likely to cover in a
194 single course focused on plant systematics. The treat-
195 ment of c. 120 families follows the classification of the
196 Angiosperm Phylogeny Group and is akin to the
197 treatment in Judd et al. in clearly illustrating the
198 practice of modern systematic biology. Simpson’s dis-
199 cussion and incorporation of literature cited associated
200 with each family are excellent, but not as in-depth as the
201 average treatment by Judd et al. Following the discus-
202 sion of families, the author continues with several
203 hundred pages associated with morphology, anatomy,
204 physiology, embryology, palynology, reproductive biol-
205 ogy, molecular systematics, nomenclature, collecting, 206

207 herbaria, etc. The incorporated scope and detail make it
 208 a particularly apt choice for faculty seeking to use plant
 209 systematics as the focal point for a series of related
 210 botany courses. The text could function as the primary
 211 reading for many components of a traditional introduc-
 212 tory botany course, most topics covered in a plant
 213 systematics course, and many components covered in a
 214 plant morphology and anatomy course.

215 For 33 years Walters, Keil, and Murrell's *Vascular*
 216 *Plant Taxonomy* (Kendall/Hunt Publishing, 2006,
 217 MSRP \$80.95 in soft cover) has been a staple in many
 218 plant systematics courses. Now in its fifth edition, the
 219 coverage of *c.* 75 families includes more general
 220 description and discussion of fewer plant families than
 221 the other two books. This treatment is an explicit part of
 222 the authors goal "to prepare a text that can serve as an
 223 introduction to taxonomy and that is thorough enough
 224 to provide a solid background for student, but not so
 225 detailed that students feel overwhelmed..." They have
 226 truly excelled in their stated objective. This is an
 227 excellent book focusing less on phylogenetic systematics
 228 of angiosperms (i.e. limited specific discussion of current
 229 phylogenies and tested characters) as a topic and more
 230 on directed student learning of general systematic
 231 biology as well as plant families and associated identi-
 232 fying characteristics. Members of the Hennig Society
 233 will especially appreciate the opening line of the chapter
 234 entitled "Phylogenetic Classification", in which the

authors begin "In 1950 a German entomologist, Willi 235
 Hennig, proposed a new method of phylogenetic clas- 236
 sification". If the coverage matches your course goals, 237
 the newest edition of the book remains an outstanding 238
 option. 239

In my view the relative strength of *Plant Systematics* 240
 by Judd et al. can be found in the 400 plus pages of 241
 synthesis on modern vascular plant classification and 242
 phylogenetics in addition to the clear discussion of 243
 identifying features for families, the instructors CD, and 244
 the photographic CD. The detail incorporated into the 245
 coverage of specific groups is considerably above what is 246
 likely to be offered in the average undergraduate course, 247
 but these added components are far from distracting. It 248
 is these sections, along with much of the introductory 249
 material, that will convince students to keep the text as a 250
 reference for the future and why many graduate students 251
 and faculty will purchase the book outside the context of 252
 an undergraduate course. 253

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