

2007

Towards a Comprehensive Survey of C3 and C4 Photosynthetic Pathways in Cyperaceae

Jeremy J. Bruhl

University of New England, Armidale, New South Wales, Australia

Karen L. Wilson

Royal Botanic Gardens, Sydney, New South Wales, Australia

Follow this and additional works at: <http://scholarship.claremont.edu/aliso>

 Part of the [Botany Commons](#), [Ecology and Evolutionary Biology Commons](#), and the [Plant Biology Commons](#)

Recommended Citation

Bruhl, Jeremy J. and Wilson, Karen L. (2007) "Towards a Comprehensive Survey of C3 and C4 Photosynthetic Pathways in Cyperaceae," *Aliso: A Journal of Systematic and Evolutionary Botany*: Vol. 23: Iss. 1, Article 11.
Available at: <http://scholarship.claremont.edu/aliso/vol23/iss1/11>

TOWARDS A COMPREHENSIVE SURVEY OF C₃ AND C₄ PHOTOSYNTHETIC PATHWAYS IN CYPERACEAE

JEREMY J. BRUHL^{1,3} AND KAREN L. WILSON²

¹Botany, Centre for Ecology, Evolution and Systematics, University of New England, Armidale, New South Wales 2351, Australia; ²National Herbarium of New South Wales, Royal Botanic Gardens, Sydney, New South Wales 2000, Australia (karen.wilson@rbgsyd.nsw.gov.au)

³Corresponding author (jbruhl@une.edu.au)

ABSTRACT

Members of the family Cyperaceae were surveyed by original observation and from the literature to assess the distribution of C₃ and C₄ photosynthetic pathways in the family. All 107 genera were included in the current sample, with 91 genera assessed as consistently C₃ and 11 genera as C₄. The genera *Abildgaardia*, *Cyperus*, *Eleocharis*, *Fimbristylis*, and *Rhynchospora* are variable for this trait. Of the total number (1474) of specific (1406) and infraspecific (68) taxa sampled, 938 taxa (63%) are C₃, 527 taxa (36%) are C₄, and nine species of *Eleocharis* are debatably intermediate or variable in pathway. Some data suggesting further infrageneric variation in photosynthetic pathways are discussed. The “one cell distant criterion” accurately predicts C₄ pathway in sedges, except in *Eleocharis*. Distribution and variability of photosynthetic pathways in *Eleocharis* are discussed. Photosynthetic pathway was found to be a useful taxonomic marker in Cyperaceae, despite variability in this trait at various taxonomic levels and the apparently multiple origin of C₄ photosynthesis within the family. A checklist of 3395 records of C₃ and C₄ sedges is presented.

Key words: C₃, C₄, C₃-C₄ intermediate, Cyperaceae, δ¹³C values, *Eleocharis*, Γ, photosynthetic pathway, sedge.

INTRODUCTION

Two distinct patterns of vegetative anatomy in sedges have long been recognized (Haberlandt 1884: 281). One, with “radiate” chlorenchyma and a green (chlorenchymatous) sheath situated within the vascular bundles (Kranz anatomy), “is seen in certain species of *Cyperus*” (Haberlandt 1884: 284). The other, exemplified by *Carex* and many other *Cyperus* species, involves non-radiate chlorenchyma and vascular bundles enclosed by a “sheath of large colorless cells.” Botanists were quick to incorporate these discontinuities into the taxonomic framework of Cyperaceae, e.g., “Chlorocyperaceen” and “Eucyperaceen” of Rikli (1895: 560), see also Clarke (1908). More recent authors (e.g., Druyts-Voets 1970; Metcalfe 1971), in extending these anatomical studies and recognizing further variants (e.g., Sharma and Mehra 1972; Carolin et al. 1977; Gilliland and Gordon-Gray 1978; Bruhl et al. 1987; Bruhl 1995), have extended the taxonomic utility of vegetative anatomy in this family.

Subsequent to the discovery of the C₄ photosynthetic pathway, the correlations between chlorocyperoid (Kranz) anatomy and C₄ photosynthesis, and eucyperoid anatomy and C₃ (Calvin cycle) photosynthesis became apparent. Further correlations were detected within Cyperaceae, as with other families, of photosynthetic pathways with characteristic carbon isotope ratio (δ¹³C value) ranges (Bender 1971), with CO₂ compensation point (Γ) values (Krenzer et al. 1975), and with geographical distributions, there being a concentration of C₄ sedge species and genera in the tropics and C₃ taxa in the temperate regions (Raynal 1972). Biochemistry has also been used to assess pathways (Bruhl et al. 1987; Sage et al. 1999), by measuring the ratio of phosphoenol-

pyruvate carboxylase (PEPCase) to ribulose-1,5-bisphosphate carboxylase (Rubisco) activity and by measuring the initial products of photosynthesis. Use of these correlates, particularly anatomical and δ¹³C values, has allowed extensive prediction of C₃ and C₄ photosynthetic pathways in sedges (Bruhl et al. 1992; Bruhl 1993, 1995), and has led to a re-assessment, along structural/functional and evolutionary lines (Soros and Bruhl 2000), of earlier taxonomic decisions based on purely anatomical discontinuities. Thus Raynal (1973) positioned his predominantly C₄ Cyperaceae and Fimbristylideae as terminal assemblages in a scheme of phylogenetic relationships of the Cyperoideae, with the C₄ genera uppermost, indicating their assumed derived states. Molecular studies by Muasya et al. (1998, 2002) found C₃ taxa sister to C₄ taxa, indicating that *rbcL*, a photosynthetic gene, reflects phylogeny.

There is need for some caution when using anatomical observations or δ¹³C values alone as predictors of photosynthetic pathway, since C₃-C₄ intermediates may be overlooked (Bruhl et al. 1987; Hattersley 1987; Bruhl and Perry 1995; Sage 2002). The “maximum cells distant count” (Hattersley and Watson 1975) has proved to be a very reliable anatomical criterion in relation to grasses (Hattersley 1987). This explicit anatomical criterion for C₃/C₄ assignment, though seemingly applicable to sedges (Hattersley et al. 1977), had not previously been tested on them on a large scale. Instead, the relatively vague concepts of “radiate” chlorenchyma and “Kranz” anatomy (e.g., Ueno and Koyama 1987) have continued in use (Bruhl et al. 1987).

Cyperaceae have been covered in a number of surveys of photosynthetic pathway variation (e.g., Black 1976; Raghavendra and Das 1976; Takeda et al. 1985; Wang 2003), and

various taxonomic conclusions regarding the family have been drawn (Lerman and Raynal 1972; Raynal 1973; Takeda et al. 1985). Major contributions to C₃/C₄ assessments, in terms of the numbers of species and genera sampled, have been made by Lerman and Raynal (1972, see below) and Takeda et al. (1985). No genus remains unknown in this respect, though there is conflicting information about the photosynthetic pathways of some.

We have obtained additional anatomical, $\delta^{13}\text{C}$ and Γ data to examine critically the correlation between physiological, biochemical, and anatomical data pertaining to photosynthetic pathways, and to fill significant gaps in the taxonomic coverage, to locate new variation within genera, and to identify taxa where C₃-C₄ intermediates may occur. In what follows, those new observations are presented and current knowledge of C₃/C₄ photosynthetic pathway variation in Cyperaceae is summarized. Appendix 1 contains the first extensive, up-to-date compilation of photosynthetic pathway determinations for Cyperaceae, with sources, and presents, also for the first time, the valuable, original data underlying the publications by Lerman and Raynal (1972), Raynal (1972, 1973), and Stock et al. (2004). All new, previously unpublished data and previously published data are compiled in Appendix 1. The compilation is believed to be comprehensive with respect to the physiological and biochemical data.

MATERIALS AND METHODS

Plant Material

For study of living material, plants collected from across Australia were grown under half-shade in glasshouses maintained between 35°C (day maximum) and 15°C (night minimum), and regularly fertilized with Ruakura nutrient solution (Smith et al. 1983). Identities were checked and vouchers have been lodged at CANB or NE (by JJB) or NSW (by KLW). Where samples were taken from herbarium material, voucher labels were attached to the sheets.

Anatomy and "One Cell Distant Criterion"

Plant material was selected and prepared as stated in Bruhl et al. (1987), Wilson (1991), and Bruhl and Perry (1995). Hand-cut sections of rehydrated herbarium material or fresh material, temporarily mounted, are generally adequate for ascertaining the "maximum cells distant count" and applying the "one cell distant criterion." The latter states that "in C₄ species no chlorenchymatous mesophyll cell is separated from the nearest parenchymatous bundle sheath (PBS) cell by more than one other chlorenchymatous mesophyll cell" (Hattersley and Watson 1975: 325). In Cyperaceae, application of this criterion involves counting the numbers of primary carbon assimilation (PCA) cells distant from the photosynthetic carbon reduction (PCR) cells, ignoring non-PCR mestome sheath cells, PBS cells and any non-chlorenchymatous cells.

CO₂ Compensation Point Analyses

A pulse flow system for CO₂ compensation point analysis (Brown et al. 1985; Brown and Hattersley 1989) was used. Fresh healthy leaves or culms (photosynthetic material only)

of glasshouse-grown plants were placed in a 50 mL clear glass syringe. The syringe was fitted with a needle and the needle tip sealed with a rubber plug. The plunger was made airtight by lubrication with liquid paraffin. The sealed loaded syringe was placed in a growth cabinet under a photosynthetic photon flux density of 500 $\mu\text{mol quanta m}^{-2}\text{s}^{-1}$ at 30°C, and was incubated for at least 20 minutes. A 30 mL gas sample from the syringe was then passed through a calcium chloride H₂O trap, to an infrared CO₂ gas analyzer (model ZAR, Fuji Electric, Tokyo, Japan). High grade nitrogen, at a flow rate of 4 liters min⁻¹, was used as a carrier gas. The output from the analyzer was recorded on an RDK Rikadenki chart recorder (RDK, Tokyo, Japan). The system was calibrated with 1, 2, and 3 mL samples of pure CO₂ (delivered with an SGE microlitre syringe) equivalent to 33.3, 66.6, and 100 parts per million (ppm) of CO₂ in 30 mL volumes, respectively. The CO₂ concentration of the sample gas was calculated from the peak height of the CO₂ pulse. Controls were used to ensure that the sole source of CO₂ was that derived from the sample, and constituted the delivery of 30 mL of CO₂-free air, which resulted in no pen movement beyond the base line. The Γ values of JJB presented in Appendix 1 represent means based on four replicates, except for the controls, where there were two replicates.

$\delta^{13}\text{C}$ Values

(a) *This study (see Bruhl 1990).*—For $\delta^{13}\text{C}$ value determinations by JJB, mature healthy leaf or culm samples from cultivated plants oven-dried at 70°C, or from herbarium specimens, were ground finely in liquid nitrogen with a mortar and pestle, or chopped finely with a razor. Samples of 0.2 to 3 mg were combusted using a modification of the classical Dumar method in a Carlo Erba 1106 Elemental Analyzer (CE Instruments, Milan, Italy). The CO₂ produced was trapped automatically at liquid nitrogen temperature, then distilled from the cold finger and passed to a VG Isogas Sira-24 mass spectrometer (Thermo Electron Corporation, Boston, Massachusetts, USA) for analysis. Standards used were the laboratory internal CO₂ standard gas and a standardized sucrose calibrated against international carbonate standards. The ¹³C/¹²C ratios are reported as $\delta^{13}\text{C}$ values in ‰.

(b) *Source of values used in Lerman and Raynal (1972).*—Before his untimely death, Jean Raynal gave K. L. Wilson (NSW) a copy of the data sheets for the $\delta^{13}\text{C}$ value determinations associated with their landmark papers (Lerman and Raynal 1972; Raynal 1972, 1973). After receiving a copy and seeking permission from Dr. Lerman, J. J. Bruhl incorporated these data in a survey of photosynthetic pathways (Bruhl 1990). Lerman and Raynal's data are presented here, in full, in a refereed publication for the first time.

(c) *Source of values used in Stock et al. (2004).*—While the present paper was in review, a paper by Stock et al. (2004) appeared in *Austral Ecology* with data in summary form only. Professor Will Stock and Dr. Tony Verboom kindly agreed to make their data available to us, and we present them here, in full, for the first time.

Evaluation of Literature; Nomenclature

Photosynthetic pathway determinations were collated from original publications, rather than from reviews, and anatomical data from publications preceding the discovery of C_4 photosynthesis have been used only where they permit unambiguous interpretation. Description of leaf or stem chlorenchyma as radiate is not a reliable criterion for assigning photosynthetic pathway (Bruhl et al. 1987) and was ignored. For example, consider “chlorenchyma slightly radiating” (Govindarajulu 1969a: 28) for species of *Fuirena* that are C_3 and “chlorenchyma not radiating” (Govindarajulu 1974: 245–246) for *Cyperus clarkei* T. Cook, which is C_4 . For methods used to assess photosynthetic pathways see the original papers.

Nomenclature and generic and subgeneric circumscriptions used here are informed by the relatively recent classifications and studies of Cyperaceae (especially Bruhl 1995; Goetghebeur 1998; Muasya et al. 2000) and the arrangement of Cyperaceae at the National Herbarium of New South Wales (NSW) by KLW, as well as the draft World Checklist of Cyperaceae being coordinated by D. Simpson and R. Govaerts from Royal Botanic Gardens, Kew, with contributions from other cyperologists such as the present authors.

RESULTS AND DISCUSSION

The draft World Checklist of Cyperaceae (see above) lists 103 genera and about 5400 species in Cyperaceae. For the current study we recognize 107 genera of which all genera and 1406 species and an additional 68 subspecies and varieties have been investigated for photosynthetic pathway (Appendix 1) anatomically (2350 records), or physiologically and/or biochemically (1045 records), totaling 3395 records (Appendix 1). The compilation includes new Γ values for seven genera and 29 species, new $\delta^{13}C$ value determinations for 15 genera and 50 species and 1047 new anatomical records obtained in this study, along with 1305 anatomical records based on our assessment of published literature. In addition, we present the 246 original $\delta^{13}C$ value determinations summarized by, but not presented in, Lerman and Raynal (1972), as well as the 68 original $\delta^{13}C$ value records of Stock et al. (2004).

The determination of photosynthetic pathways, particularly at the generic level, is comprehensive for this reasonably large family, and affords a sound basis from which to generalize about the likelihood of finding further variation, predict the photosynthetic pathway of the unassessed taxa, and discuss taxonomic implications of the available data. All genera that we recognize here can be assigned to a photosynthetic pathway (Table 1) with confidence on the basis of biochemical, physiological, and anatomical evidence (Appendix 1). The present state of knowledge shows that *Abildgaardia*, *Cyperus* s.l., *Eleocharis*, *Fimbristylis*, and *Rhynchospora* s.l. are variable, comprising both C_3 and C_4 species, while the remaining genera are consistently either C_3 (91 genera) or C_4 (11 genera) (Table 1; Appendix 1) (see also Bruhl et al. 1987; Bruhl and Perry 1995; Soros and Bruhl 2000). Of the total number (1474) of specific (1406) and infraspecific (68) taxa sampled, 938 taxa (63%) are C_3 , 527 taxa (36%) are C_4 , and nine species of *Eleocharis* are debatably intermediate or variable in pathway.

Sage et al. (1999), based on data and generalizations from Bruhl et al. (1992) and Bruhl (1995), gave the percentage of genera and species of Cyperaceae that are C_4 as 21% and 27%, respectively. Here, not recognizing as many segregate genera, and including only the species actually examined (Appendix 1), we find that 15% of genera (including the five genera that are variable for photosynthetic pathway) and 34% of the species sampled are C_4 . Given the different bases of the calculations, their similarity provides some confidence in them. The differences in numbers, however, indicate the need to continue to improve the estimate of phylogeny for the family and hence a better basis for its classification, and the need to complete the survey of photosynthetic pathways of species of Cyperaceae.

The anatomical sample is rather patchy at the species level, in that most of the smaller genera, along with some large ones (e.g., *Cyperus*, *Eleocharis*, and *Rhynchospora*) have been extensively sampled, while other large genera such as *Lagenocarpus* and *Pleurostachys* have been examined for only one or two species. Nonetheless, the sample size compares favorably with those used for many other micromorphological or anatomical features. For example, recent taxonomic treatments (Raynal 1973; Goetghebeur 1986; Bruhl 1995; Goetghebeur 1998) of Cyperaceae placed a great deal of reliance on embryo morphology, where the available data are much less comprehensive.

“One Cell Distant Criterion”

Cross-referencing between the different kinds of evidence presented in Appendix 1 shows excellent correspondence between the different methods of assessing photosynthetic pathways in this family. It also shows that, perhaps with the exception of some species of *Eleocharis* (see below), all the photosynthetic pathways are correctly predicted using anatomical criteria. The few conflicting records are considered below. The data tabulated in Appendix 1 allow evaluation of the “maximum cells distant count” as a predictor of photosynthetic pathway in Cyperaceae. Of the 105 genera investigated anatomically for this criterion by us (i.e., except for *Pleurostachys* and *Trichoschoenus*), 84 genera and many of the species sampled have also been analyzed for their $\delta^{13}C$ values, and 14 genera and 91 species for Γ . The photosynthetic pathway of 14 of the genera including 63 species has been determined biochemically. Congruence of the data shows, with the exception of *Eleocharis*, that the “one cell distant criterion” (Hattersley and Watson 1975) is an accurate predictor of C_4 in Cyperaceae, while counts of greater than one cell accurately predict C_3 . Given the simplicity and ease with which anatomical preparations can be made to determine photosynthetic pathway type, it is reasonable to suggest that such evidence and determinations should accompany the descriptions of new species and genera as a matter of routine.

In *Eleocharis*, the unequivocally C_4 taxa (Appendix 1; Bruhl et al. 1987) yield counts of one to four cells, i.e., often exceeding a count of one, even if the chlorophyllous layer of cells adjacent to the mestome sheath is considered to constitute a PBS and ignored (Bruhl et al. 1987). However, the chloroplast abundance in the PCA (C_4 mesophyll) cells is relatively low and the more distant cells are equivocally

Table 1. Genera and generic sample for distribution of photosynthetic pathway in Cyperaceae. (^ = World Checklist of Cyperaceae; www.kew.org/wcsp/home.do) (Simpson et al. 2005); incl. = including; PP = photosynthetic pathway; * = includes two additional species published since first version of Checklist was distributed to cyperologists in 2004).

Genera sampled (unless indicated otherwise)	PP	World Checklist [^]	No. of species [^]
<i>Abildgaardia</i> Vahl	C ₃ /C ₄	(= <i>Fimbristylis</i>)	
<i>Actinoschoenus</i> Benth.	C ₃	<i>Actinoschoenus</i>	3
<i>Actinoscirpus</i> (Ohwi) R. Haines & K. Lye	C ₃	<i>Actinoscirpus</i>	1
<i>Afrotrolepis</i> (Gilg) J. Raynal	C ₃	<i>Afrotrolepis</i>	2
<i>Alinula</i> J. Raynal	C ₄	<i>Alinula</i>	4
<i>Amphiscirpus</i> Oteng-Yeboah	C ₃	<i>Amphiscirpus</i>	1
<i>Androtrichum</i> (Brongn.) Brongn.	C ₃	<i>Androtrichum</i>	2
<i>Arthrostylis</i> R. Br.	C ₃	<i>Arthrostylis</i>	1
<i>Ascolepis</i> Nees ex Steud.	C ₄	<i>Ascolepis</i>	22
<i>Asterochaete</i> Nees	C ₃	(= <i>Carpha</i>)	
<i>Baumea</i> Gaudich.	C ₃	(= <i>Machaerina</i>)	
<i>Becquerelia</i> Brongn.	C ₃	<i>Becquerelia</i>	8
<i>Bisboeckelera</i> Kuntze	C ₃	<i>Bisboeckelera</i>	4
<i>Blysmus</i> Panz. ex Schult.	C ₃	<i>Blysmus</i>	3
<i>Bolboschoenus</i> (Aschers.) Palla	C ₃	<i>Bolboschoenus</i>	10
<i>Bulbostylis</i> Kunth	C ₄	<i>Bulbostylis</i>	206
<i>Calyptracarya</i> Nees	C ₃	<i>Calyptracarya</i>	8
<i>Capeobolus</i> J. Browning	C ₃	<i>Capeobolus</i>	1
<i>Capitularina</i> Kern	C ₃	<i>Capitularina</i>	1
<i>Carex</i> L. (incl. <i>Cymophyllus</i> Mack. ex Britton & A. Br. and <i>Vesicarex</i> Steyerem.)	C ₃	<i>Carex</i>	1757
<i>Carpha</i> Banks & Sol. ex R. Br.	C ₃	<i>Carpha</i>	16
<i>Caustis</i> R. Br.	C ₃	<i>Caustis</i>	5
<i>Cephalocarpus</i> Nees	C ₃	<i>Cephalocarpus</i>	4
(= <i>Eleocharis</i>)		<i>Chillania</i> Roiv.	1
<i>Chorizandra</i> R. Br.	C ₃	<i>Chorizandra</i>	5
<i>Chrysitrix</i> L.	C ₃	<i>Chrysitrix</i>	4
<i>Cladium</i> P. Browne	C ₃	<i>Cladium</i>	3
<i>Coleochloa</i> Gilly	C ₃	<i>Coleochloa</i>	7
<i>Costularia</i> C. B. Clarke (incl. <i>Lophoschoenus</i> Stapf)	C ₃	<i>Costularia</i>	24
<i>Courtoisina</i> Soják	C ₃	<i>Courtoisina</i>	2
<i>Crosslandia</i> W. V. Fitzg.	C ₄	<i>Crosslandia</i>	1
<i>Cyathochaeta</i> Nees	C ₃	<i>Cyathochaeta</i>	6
<i>Cyathocoma</i> Nees	C ₃	(= <i>Tetraria</i>)	
<i>Cyperus</i> L. (incl. <i>Anosporum</i> Nees, <i>Juncellus</i> (Griseb.) C. B. Clarke, <i>Mariscus</i> Vahl, <i>Remirea</i> Aubl., <i>Torulinium</i> Desv.)	C ₃ /C ₄	<i>Cyperus</i>	686
(= <i>Carex</i>)	C ₃	<i>Cymophyllus</i>	1
<i>Cypringlea</i> M. Strong	C ₃	<i>Cypringlea</i>	2
<i>Desmoschoenus</i> Hook. f.	C ₃	<i>Desmoschoenus</i>	1
<i>Didymiandrum</i> Gilly	C ₃	<i>Didymiandrum</i>	1
<i>Diplacrum</i> R. Br.	C ₃	<i>Diplacrum</i>	9
<i>Diplasia</i> Rich. ex Pers.	C ₃	<i>Diplasia</i>	1
<i>Dulichium</i> Pers.	C ₃	<i>Dulichium</i>	1
<i>Egleria</i> L. T. Eiten	C ₃	<i>Egleria</i>	1
<i>Eleocharis</i> R. Br.	C ₃ /C ₄	<i>Eleocharis</i>	252
<i>Epischoenus</i> C. B. Clarke	C ₃	<i>Epischoenus</i>	8
<i>Eriophorum</i> L. (incl. <i>Eriophoropsis</i> Palla & <i>Erioscirpus</i> Palla)	C ₃	<i>Eriophorum</i>	18
<i>Evandra</i> R. Br.	C ₃	<i>Evandra</i>	2
<i>Everardia</i> Ridl. ex Oliver	C ₃	<i>Everardia</i>	12
<i>Exocarya</i> Benth.	C ₃	<i>Exocarya</i>	1
<i>Exochogyne</i> C. B. Clarke	C ₃	<i>Exochogyne</i>	3
<i>Ficinia</i> Schrad. (incl. <i>Sickmannia</i> Nees)	C ₃	<i>Ficinia</i>	72
<i>Fimbristylis</i> Vahl (incl. <i>Tylocarya</i> Nelmes)	C ₃ /C ₄	<i>Fimbristylis</i>	306
<i>Fuirena</i> Rottb.	C ₃	<i>Fuirena</i>	58
<i>Gahnia</i> J. R. Forst. & G. Forst.	C ₃	<i>Gahnia</i>	41
<i>Gymnoschoenus</i> Nees	C ₃	<i>Gymnoschoenus</i>	2
<i>Hellmuthia</i> Steud.	C ₃	<i>Hellmuthia</i>	1
<i>Hypolytrum</i> Rich.	C ₃	<i>Hypolytrum</i>	57
<i>Isolepis</i> R. Br. (incl. <i>Eleogiton</i> Link)	C ₃	<i>Isolepis</i>	74
<i>Karinia</i> A. Reznicek & R. McVaugh	C ₃	<i>Karinia</i>	1
<i>Chaosokia</i> D. A. Simpson, Chayam. & J. Parn.	C ₃	(Not in first version of World Checklist)	1

Table 1. Continued.

Genera sampled (unless indicated otherwise)	PP	World Checklist [^]	No. of species [^]
<i>Kobresia</i> Willd.	C ₃	<i>Kobresia</i>	71
<i>Koyamaea</i> W. W. Thomas & G. Davidse	C ₃	<i>Koyamaea</i>	1
<i>Kyllinga</i> Rottb. (~ <i>Cyperus</i>)	C ₄	<i>Kyllinga</i>	73
<i>Kyllingiella</i> R. Haines & K. Lye	C ₃	<i>Kyllingiella</i>	3
<i>Lagenocarpus</i> Nees	C ₃	<i>Lagenocarpus</i>	61
<i>Lepidosperma</i> Labill.	C ₃	<i>Lepidosperma</i>	56
<i>Lepironia</i> Rich.	C ₃	<i>Lepironia</i>	1
<i>Lipocarpa</i> R. Br.	C ₄	<i>Lipocarpa</i>	36
<i>Machaerina</i> Vahl	C ₃	<i>Machaerina</i>	51
<i>Mapania</i> Aubl. (incl. <i>Thoracostachyum</i> Kurz)	C ₃	<i>Mapania</i>	84
<i>Mesomelaena</i> Nees	C ₃	<i>Mesomelaena</i>	5
<i>Microdracoides</i> Hua	C ₃	<i>Microdracoides</i>	1
<i>Morelotia</i> Gaudich.	C ₃	<i>Morelotia</i>	2
<i>Neesenbeckia</i> Levyns	C ₃	<i>Neesenbeckia</i>	1
<i>Nelmesia</i> Van der Veken	C ₄	<i>Nelmesia</i>	1
<i>Nemum</i> Desv.	C ₄	<i>Nemum</i>	5
<i>Oreobolopsis</i> T. Koyama & E. R. Guaglianone	C ₃	<i>Oreobolopsis</i>	3
<i>Oreobolus</i> R. Br. (incl. <i>Chillania</i> Roiv.)	C ₃	<i>Oreobolus</i>	17
<i>Oxycaryum</i> Nees	C ₃	<i>Oxycaryum</i>	1
<i>Paramapania</i> Uittien	C ₃	<i>Paramapania</i>	7
<i>Phylloscirpus</i> C. B. Clarke	C ₃	<i>Phylloscirpus</i>	3*
<i>Pleurostachys</i> Brongn.	C ₃	<i>Pleurostachys</i>	50
<i>Principina</i> Uittien	C ₃	<i>Principina</i>	1
<i>Pseudoschoenus</i> (C. B. Clarke) Oteng-Yeboah	C ₃	<i>Pseudoschoenus</i>	1
<i>Ptilothrix</i> K. L. Wilson	C ₃	<i>Ptilothrix</i>	1
<i>Pycreus</i> Beauv. (~ <i>Cyperus</i>)	C ₄	<i>Pycreus</i>	118
<i>Queenslandiella</i> Domin (~ <i>Cyperus</i>)	C ₄	<i>Queenslandiella</i>	1
<i>Reedia</i> F. Muell. (= <i>Cyperus</i>)	C ₃	<i>Reedia</i>	1
<i>Rhynchocladium</i> T. Koyama	C ₃	<i>Remirea</i> Aubl.	1
<i>Rhynchospora</i> Vahl	C ₃ /C ₄	<i>Rhynchocladium</i>	1
<i>Schoenoplectus</i> (Rchb.) Palla	C ₃	<i>Rhynchospora</i>	341
<i>Schoenoxiphium</i> Nees	C ₃	<i>Schoenoplectus</i>	64
<i>Schoenus</i> L.	C ₃	<i>Schoenoxiphium</i>	20
<i>Scirpodendron</i> Zipp. ex Kurz	C ₃	<i>Schoenus</i>	108
<i>Scirpoides</i> Ség.	C ₃	<i>Scirpodendron</i>	2
<i>Scirpus</i> L.	C ₃	<i>Scirpoides</i>	3
<i>Scleria</i> Berg.	C ₃	<i>Scirpus</i>	67
<i>Sphaerocyperus</i> K. Lye	C ₄	<i>Scleria</i>	264
<i>Sumatrosirpus</i> Oteng-Yeboah	C ₃	<i>Sphaerocyperus</i>	1
<i>Tetraria</i> Beauv.	C ₃	<i>Sumatrosirpus</i>	1
<i>Trachystylis</i> S. T. Blake	C ₃	<i>Tetraria</i>	57
<i>Trianoptiles</i> Fenzl	C ₃	<i>Trachystylis</i>	1
<i>Trichophorum</i> Pers.	C ₃	<i>Trianoptiles</i>	3
<i>Trichoschoenus</i> J. Raynal	C ₃	<i>Trichophorum</i>	9
<i>Tricostularia</i> Nees	C ₃	<i>Trichoschoenus</i>	1
<i>Trilepis</i> Nees	C ₃	<i>Tricostularia</i>	5
<i>Uncinia</i> Pers.	C ₃	<i>Trilepis</i>	7
<i>Volkiella</i> Merxm. & Czech.	C ₃	<i>Uncinia</i>	66
<i>Websteria</i> S. H. Wright	C ₃	<i>Volkiella</i>	1
<i>Zameioscirpus</i> Dhooge & Goetgh.	C ₃	<i>Websteria</i>	1
		(Not in first version of World Checklist)	
107 genera sampled		104 genera	5401

chlorophyllous. Even where the criterion can be applied with confidence, the PBS may be chlorophyllous or more or less non-chlorophyllous (e.g., in *Fimbristylis*), with variation apparent within and between species. The stoichiometric and physiological significance of such variation is not clear, and warrants further investigation.

C₄ sedges are generally NADP-ME, whereas the C₄ species of *Eleocharis* are NAD-ME type—the only occurrence of this biochemical type in Cyperaceae. So variation in biochemical type coincides with breakdown of the C₄ anatomical predictor (Ueno et al. 1986; Bruhl et al. 1987). The breakdown does not seriously impair use of the “one cell

distant criterion” in predicting photosynthetic pathway, because of the apparent rarity of the NAD-ME type in this family. Although C_4 *Eleocharis* species would be incorrectly assigned to photosynthetic pathway using this criterion, they are accurately predicted by ultrastructural features of the mitochondria and chloroplast grana in PCR cells (Bruhl and Perry 1995). Exceptions to the “one cell distant criterion” highlight the advantage of using at least two means to assess photosynthetic pathway in Cyperaceae. Anatomy, $\delta^{13}C$ value, and ultrastructure have the advantage that they can be assessed from fresh or herbarium samples.

Conflicting Reports

There are conflicting reports about the photosynthetic pathway status of some species (marked with “+” in Appendix 1). We suggest that most, if not all, of these conflicts result from misidentification of the material studied (see Appendix 2 for discussion). Some vouchers have been reexamined and redetermined by the current authors. These redeterminations together with our assessment of the conflicts are indicated in Appendix 1.

One case is presented here as it highlights the need for publication of data (= results) and for vouchers to be lodged in recognized herbaria to underpin discussion and conclusions in scientific papers. In their recent publication, Stock et al. (2004) submitted $\delta^{13}C$ data linked to vouchers deposited in a recognized herbarium but were not allowed by the journal to include them in the paper. The summary $\delta^{13}C$ data (Stock et al. 2004: Table 1) contained two surprises. One species of *Lipocarpus* is listed as C_3 and one of *Schoenoplectus* is listed as C_4 . The specific data obtained from the authors reveal these species to be *L. rehmannii* and *S. pulchellus* (Appendix 1). Their datum for *L. rehmannii* is at odds with five other records for the species based on anatomical observations and $\delta^{13}C$ values. All the pieces of this specimen appear to match other material of *L. rehmannii* at BOL (A. Verboom pers. comm., Aug 2004). We hope to examine this specimen anatomically. The C_4 $\delta^{13}C$ value for *S. pulchellus* is the first report for this species. We do not yet have access to material of this species to check it. The specimen in question is not mixed and appears to have been correctly identified by cyperologist Jane Browning (A. Verboom pers. comm., Aug 2004). There are 52 records of C_3 pathway for the genus (Appendix 1), plus two apparently anomalous C_4 reports for *S. lateriflorus* (Hofstra et al. 1972). We plan to survey all the species in this genus for photosynthetic pathway and clarify the photosynthetic pathway status of *S. pulchellus*. To minimize the chance of erroneous reports, to support novel findings, and to allow the authentication of names used in botanical studies it is crucial that journals and book editors insist on the publication at the same time of supporting data linked to voucher specimens lodged in a recognized herbarium (see also Goldblatt et al. 1992; Hosking et al. 1996).

Significance of Photosynthetic Pathways for Solving Taxonomic Problems

Two contrasting and independent examples indicate the value of photosynthetic pathway data in posing or solving taxonomic problems. Firstly, the monotypic *Syntrinema* H.

Pfeiff. is variously regarded, largely on the basis of floral morphology, as belonging to *Rhynchospora* (Ballard 1934; Goetghebeur 1986; Wayt Thomas pers. comm.) or as a genus belonging to a separate tribe (Eiten 1976). It is C_4 (Appendix 1), and its vegetative anatomy (Bruhl et al. 1987; Ueno and Koyama 1987) is typical of the C_4 *Rhynchospora* species with rhynchosporoid anatomy (Bruhl et al. 1987). Rhynchosporoid anatomy is found only in these two genera and, therefore, strongly supports the former taxonomic affiliation. We have included *Syntrinema* here under *Rhynchospora*.

Secondly, *Abildgaardia* and *Fimbristylis*, two closely related and often synonymized genera (Bruhl et al. 1992; Bruhl 1995; Ghamkhar et al. 2007), have previously been considered to be exclusively C_4 (Appendix 1). Indeed, Raynal (1973) and Goetghebeur (1986) place these genera in a tribe in part characterized by C_4 photosynthesis and fimbristylid anatomy (see Bruhl et al. 1987). Our anatomical observations and $\delta^{13}C$ value data (Appendix 1), however, indicate that *Abildgaardia hygrophila* and *Fimbristylis variegata* are C_3 . Furthermore, Gordon-Gray's (1971: 562) observations for *F. variegata* (“even the smaller bundles of the outer ring lie not within the mesophyll but merely in contact with its inner margin . . . The mesophyll in this species is especially well organized, the cells being palisade-like”), considered in retrospect, also hint at C_3 anatomy and Metcalfe's (1971: 276) description of the chlorenchyma in *A. hygrophila* (treated under *Fimbristylis*; “up to 6 layers of palisade cells”) clearly indicates C_3 anatomy.

Photosynthetic pathway and vegetative anatomy are valuable in substantiating the inclusion of *Syntrinema* in *Rhynchospora*. In most cases, photosynthetic pathway is a valuable taxonomic criterion (as seen by its consistency within most genera), but the *Abildgaardia* example illustrates the need for caution when generalizing from small samples of species.

Eleocharis

Rikli's (1895) “Chlorocyperaceen” genera have generally been found to be C_4 (Lerman and Raynal 1972), e.g., *Ascolepis*, *Cyperus* subgen. *Cyperus*, *Fimbristylis*, *Kyllinga*, *Lipocarpus*, and *Monandrus* ined. Rikli (1895) suggested division of the essentially helophytic genus *Eleocharis* (as *Heleocharis*) into two genera: *Eleocharis* with “eucyperoid” anatomy, and *Chlorocharis* with “chlorocyperoid” anatomy (i.e., with an inner chlorophyllous parenchyma sheath, or boundary layer cells). This seemed to be misleading in the context of photosynthetic pathways, in that subsequent literature on *Eleocharis* anatomy and photosynthetic pathway indicated a solidly C_3 genus, i.e., including some of his species of *Chlorocharis*.

More recently it has been shown that at least some species of *Eleocharis* (including one “*Chlorocharis*” species) are C_4 (Appendix 1) (Bruhl et al. 1987; Ueno et al. 1988b; see also Bruhl and Perry 1995). Of the eight species included in Rikli's (1895) *Chlorocharis*, he listed *C. palustris* (L.) Rikli (= *E. palustris*), *C. tuberculosa* (Michx.) Rikli (= *E. tuberculosa*) and *C. vivipara* (Link) Rikli (= *E. vivipara*) as having an “inner and outer parenchymatous sheath”. Terrestrial forms of *Eleocharis vivipara* have recently been found to be C_4 (and NAD-ME) (Bruhl et al. 1987; Ueno et al. 1988b, etc.), but $\delta^{13}C$ values for *E. palustris*, and *E. tuberculosa* are

typical of C_3 species (Appendix 1). Rikli (1895) listed five other species—*C. balansaeana* (Boeck.) Rikli (= *E. filiculmis*), *C. emarginata* (Nees) Rikli (= *E. quinquangularis*), *C. capitata* (L.) Rikli (= *E. geniculata*), *C. geniculata* (L.) Rikli (= *E. geniculata*), and *C. subprolifera* Rikli (= *E. pellucida*)—as having only an “inner parenchymatous sheath” (i.e., possessing prominent chlorophyllous border parenchyma), implying that a typical PBS is absent. However, one of these species, *Eleocharis geniculata*, has been examined in the present study, and it possesses an obvious non-chlorenchymatous C_3 -like PBS outside the mestome sheath (Bruhl et al. 1987); while $\delta^{13}C$ and Γ values (Appendix 1) and biochemical assays (Bruhl et al. 1987) all confirm its C_3 status. This is despite the border parenchyma cells being somewhat more prominent and chlorophyllous than in most other C_3 species (cf. Bruhl and Perry 1995).

The essentially terrestrial species *E. filiculmis*, *E. pellucida*, and *E. quinquangularis* were studied by Ueno et al. (1989). They are members of the series *Sulcatae* and *Multicaules* (with spirally disposed bracts; Svenson 1939), and are not closely related to the C_4 species of *Eleocharis* that constitute part of the series *Tenuissimae* possessing distichous floral bracts (Svenson 1937). These three species, therefore, were predicted to be C_3 (Bruhl 1990). Ueno et al. (1989) found the first two species to be C_3 , while *E. quinquangularis* was reported to be “ C_3 – C_4 ?”. Of Rikli’s *Chlorocharis*, only *E. tuberculosa* and *E. vivipara* were assigned to series *Tenuissimae* by Svenson (1937); the former is also C_3 (Ueno et al. 1989), while the dimorphic *E. vivipara* can be C_4 (Ueno et al. 1988a) (Appendix 1).

Ueno et al. (1988b) provided convincing evidence in the form of $\delta^{13}C$ values, pulse-chase experiments and C_4 acid decarboxylation enzyme assays that the terrestrial form of *E. vivipara* is C_4 and the submerged aquatic form is C_3 . Subsequent studies by Ueno and colleagues (e.g., Ueno 2001; Ueno and Ishimaru 2002) have focused on variation between and within individuals. *Eleocharis baldwinii* displays much of the intraspecific variation in photosynthetic pathway seen in *E. vivipara* (Ueno et al. 1989; Uchino et al. 1995; Ueno and Ishimaru 2002; Ueno 2004) (Appendix 1).

The variability correlates with the breakdown in the “one cell distant criterion” amongst the previously known C_4 sedges (see above; Bruhl et al. 1987), suggesting that these variabilities may have a common basis. Both the C_4 forms of *E. vivipara* and *E. baldwinii*, and the apparently consistently C_4 species of *Eleocharis* are NAD-ME type (Bruhl et al. 1987; Ueno and Samejima 1989; Bruhl and Perry 1995; Ueno 2004) and are members of ser. *Tenuissimae* (Bruhl and Smith 2002).

Eleocharis is home to further photosynthetic pathway variations that highlight its importance in understanding photosynthetic pathway evolution and development. On the basis of intermediate anatomy (Bruhl and Perry 1995), low or undetectable C_4 enzyme values (Bruhl et al. 1987), C_3 $\delta^{13}C$ values and intermediate G values (Appendix 1), supported by some ultrastructural evidence (Bruhl and Perry 1995), *E. pusilla* is interpretable as a C_3 -like C_3 – C_4 intermediate. Similarly, on the basis of intermediate anatomy and mostly C_3 -like $\delta^{13}C$ values (Ueno et al. 1989; Guaglianone and Ueno 1990) *E. cylindrica*, *E. quinquangularis*, and *E. reverchonii* are C_3 -like C_3 – C_4 intermediates or variable and in need of further study.

The variability, especially infraspecific, of photosynthetic pathways in *Eleocharis* is interesting in the context of the mechanism of development of C_4 photosynthesis (see Ueno 2001; Agarie et al. 2002; Ueno and Ishimaru 2002; Ueno and Kobayashi 2002; Ueno 2004). There is evidence that *E. baldwinii* responds to different CO_2 environments in water by shifting the relative proportion of C_3 and C_4 photosynthesis; C_4 -like intermediacy in this species is considered to be a response to CO_2 depletion (Ueno 2004).

These findings further highlight *Eleocharis* in general and specifically series *Tenuissimae* (see Bruhl and Smith 2002) as a singularly appropriate group to study the evolution and expression of the C_4 syndrome. Studies should be extended to grow a wider sample of species of *Eleocharis* that exhibit a range of photosynthetic pathway characteristics (Appendix 1) and the related aquatic monotypics *Eglaria* and *Websteria* (Bruhl 1995; Roalson and Friar 2000) under terrestrial conditions to test the stability of their C_3 status.

CONCLUSIONS

The taxonomic sample for photosynthetic pathways in Cyperaceae is particularly broad, covering all genera recognized here. Some large genera remain poorly sampled, notably *Carex* and *Scleria*, but these are considered likely not to be variable. On the other hand, more biochemical typing is necessary across the family, particularly with regard to C_4 anatomical variation in *Eleocharis* and *Rhynchospora*. Usefulness of the “one cell distant criterion” is confirmed for all groups of Cyperaceae except *Eleocharis*. The most promising and interesting area for discovery of further C_4 species or further infrageneric variation is the predominantly C_3 Scirpeae (sensu Bruhl 1995), within and around *Eleocharis*. Similarly, more study is needed of *Rhynchospora* s.l. and *Abildgaardieae*.

Information on photosynthetic pathway variation, especially with regard to anatomical aspects, has had a significant impact on taxonomy particularly at the species and generic levels (see Raynal 1973; Haines and Lye 1983).

The helophytic habit, typically associated with high light and high temperature and, by definition, availability of water, coupled with cold sensitivity, and tolerance of salinity and low nitrogen levels (Wilson 1991: 391) of many (perhaps most) C_4 sedges, particularly the C_4 species of *Eleocharis*, offers an attractive model to investigate the functional significance of C_4 photosynthesis in terms of nitrogen-use efficiency, as well as in terms of the traditional, but seemingly inappropriate, hypothesis which relates C_4 photosynthesis to water-use efficiency (see also Bruhl 1990). “ CO_2 -use efficiency” seems important for C_4 species when submerged (Ueno 2004). Future investigations of the mechanisms of C_4 photosynthesis regulation in sedges should also address questions of particular agronomic interest (e.g., control of the “world’s most troublesome weeds” (Wills 1987), the C_4 *Cyperus rotundus* and *C. esculentus*), as well as addressing fundamental questions of differentiation and development.

This paper is part of our ongoing study of photosynthetic pathways in Cyperaceae. We intend to follow up with an update of phylogenetic aspects of photosynthetic pathway (cf. Soros and Bruhl 2000). Finally, given the significance and application of a knowledge of photosynthetic pathway, we will present and maintain the survey data for Cyperaceae

via the Internet (see www.une.edu.au/botany/jjbres.htm), and encourage those who make and publish observations to contribute these new records to the ongoing database, where of course they will be fully acknowledged.

ACKNOWLEDGMENTS

JJB undertook most of the work reported in Appendix 1 under the initials "JB" as a Ph.D. student in the Taxonomy Laboratory of the Research School of Biological Sciences at the Australian National University. JJB acknowledges receipt of a Commonwealth Postgraduate Research Award. JJB thanks Les Watson and Paul Hattersley for guidance and constructive comment; Harold Brown (Athens, Georgia, USA) for help in using his Γ equipment at RSBS; Chris Frylink, Janette Lenz, and Sue Perry (Taxonomy Laboratory, RSBS) for technical help and suggestions; staff of Plant Culture services (RSBS); Graham Farquhar and colleagues (Plant Environmental Biology Group) for the mass spectrometric analysis of samples for $\delta^{13}\text{C}$ value determinations; Bryan Barlow and Judy West for kindly providing herbarium facilities and space at the Australian National Herbarium (CSIRO, Division of Plant Industry; CANB); Cathy Miller for lending her thesis; Phillip Sharpe for field assistance in the collection and identification of some specimens; Mike Godwin (Queensland National Parks and Wildlife Service) for collecting and sending material of *Eleocharis retroflexa*; Directors of the Australian National Parks and Wildlife Service and their equivalents in New South Wales, Northern Territory, Queensland, Tasmania, Victoria, and Western Australia for permission to collect in Service areas.

KLW acknowledges receipt of the raw $\delta^{13}\text{C}$ values from Jean Raynal (see below). JJB thanks J. C. Lerman (Tucson, Arizona, USA) for his permission in 1990 to present these data. KLW carried out initial sampling while at the Laboratoire de Phanérogamie, Muséum National d'Histoire Naturelle, Paris, on a French Government scholarship in 1977. The late Jean Raynal was very helpful to her at that time, as was the late Lawrie Johnson back at NSW. KLW thanks Leonie Stanberg, Rhonda Barry, Sue Bullock, Jane Dalby, and Clare Herscovitch for technical assistance at NSW.

We are most grateful to the following colleagues for helping to make our generic sample complete: Sandra Dhooge (GENT) kindly sent us images of her sections of leaves of the three species of *Phylloscirpus*; Dave Simpson (K) sent material of *Khaosokia* ined. and the manuscript (including $\delta^{13}\text{C}$ value) on that new taxon; Mark Strong (US) sent material of *Cypringlea*; Wayt Thomas (NY) material of *Rhynchocladium*; and J.-F. Veldkamp (L) material of *Sumatroscirpus*. Special thanks also to Will Stock (Edith Cowan University, Perth) and Tony Verboom (BOL) for access to, and permission to present here, data underpinning their recent *Austral Ecology* paper; thanks also to Tony Verboom for observation of and comments on some specimens in BOL.

Our thanks go to the directors and curators of the following herbaria for loans and/or access on site to their specimens and permission to sample their specimens: AAU, B, BM, BRI, CANB (and CBG), DNA, EA, GENT, HO, K, L, M, MEL, MO, NE, NOU, NSW, NY, P, PDA, PERTH, PRE, U, US. We also thank David Simpson and Rafael Govaerts (K) for sharing their draft World Checklist of Cyperaceae and involving us in that great project. We thank Richard

Carter (VSC), Nigel Warwick (UNE) and two anonymous referees for helpful comments on the manuscript, and Daniel Gooch for his timely and excellent help in converting our MS Access database to a format requested by the editors.

LITERATURE CITED

- AGARIE, S., M. KAI, H. TAKATSUI, AND O. UENO. 2002. Environmental and hormonal regulation of gene expression of C_4 photosynthetic enzymes in the amphibious sedge *Eleocharis vivipara*. *Pl. Sci. (Elsevier)* **163**: 571–580.
- AKITA, S., A. MIYASAKA, AND Y. MURATA. 1969. Studies on the differences of photosynthesis among species. I. Differences in the response of photosynthesis among species in normal oxygen concentration as influenced by some environmental factors. *Proc. Crop Sci. Soc. Japan* **38**: 507–523.
- ALVES, M. V., M. E. M. ESTELITA, M. G. J. WANDERLEY, AND W. W. THOMAS. 2002. Aplicações taxonômicas da anatomia foliar das espécies brasileiras de *Hypolytrum* Rich. (Cyperaceae). *Revista Brasil. Bot.* **25**: 1–9.
- AUCOUR, A., C. HILLAIRE-MARCEL, AND R. BONNEFILLE. 1994. Late Quaternary biomass changes from ^{13}C measurements in a highland peatbog from equatorial Africa (Burundi). *Quatern. Res.* **41**: 225–233.
- BALLARD, F. 1934. *Rhynchospora confusa* Ballard. *Hooker's Icon. Pl.* **2**: 3.
- BASKIN, J. M., AND C. C. BASKIN. 1981. Photosynthetic pathways indicated by leaf anatomy in fourteen summer annuals of Cedar Glades. *Photosynthetica* **15**: 205–209.
- BENDER, M. M. 1971. Variations in the $^{13}\text{C}/^{12}\text{C}$ ratios of plants in relation to the pathway of photosynthetic carbon dioxide fixation. *Phytochemistry* **10**: 1239–1244.
- BETTS, M. W. 1920. Notes on the autecology of certain plants of the Peridotite Belt, Nelson. Part I—Structure of some of the plants (No. 3). *Trans. New Zealand Inst.* **52**: 276–314.
- BLACK, C. C. 1976. Checklists of C_4 -dicarboxylic acid photosynthesis plant species, pp. 425–426. In R. H. Burris and C. C. Black [eds.], CO_2 metabolism and plant productivity. University of Park Press, Baltimore, Maryland, U.S.A.
- , W. H. CAMPBELL, T. M. CHEN, AND P. DITTRICH. 1973. The monocotyledons: their evolution and comparative biology. III. Pathways of carbon metabolism related to net carbon dioxide assimilation by monocotyledons. *Quart. Rev. Biol.* **48**: 298–313.
- BLACK, C. C. J., AND H. H. MOLLENHAUER. 1971. Structure and distribution of chloroplasts and other organelles in leaves with various rates of photosynthesis. *Pl. Physiol. (Lancaster)* **47**: 15–23.
- BORCHERS, E., W. FREY, AND H. H. HILGER. 1982. C_4 species in the highlands of Iran and Afghanistan. *Notes Roy. Bot. Gard. Edinburgh* **40**: 99–113.
- BOUTTON, T. W., A. TYRONE HARRISON, AND B. N. SMITH. 1980. Distribution of biomass of species differing in photosynthetic pathway along an altitudinal transect in Southeastern Wyoming grassland. *Oecologia* **45**: 287–298.
- BROWN, R. H., J. H. BOUTON, P. T. EVANS, H. E. MALTER, AND L. L. RIGSBY. 1985. Photosynthesis, leaf anatomy, and cytogenetics of hybrids between C_3 and C_3/C_4 *Panicum* species. *Pl. Physiol. (Lancaster)* **77**: 653–658.
- , AND P. W. HATTERSLEY. 1989. Leaf anatomy of C_4 species as related to evolution of C_4 photosynthesis. *Pl. Physiol. (Lancaster)* **91**: 1543–1550.
- BROWN, W. V. 1975. Variations in anatomy, associations and origins of Kranz tissue. *Amer. J. Bot.* **62**: 395–402.
- BRUHL, J. J. 1990. Taxonomic relationships and photosynthetic pathways in the Cyperaceae. Ph.D. thesis, Australian National University, Canberra, Australia. 196 pp.
- . 1993. Sedge genera of the world. *Delta Newslett.* **8**: 19.

- . 1995. Sedge genera of the world: relationships and a new classification of the Cyperaceae. *Austral. Syst. Bot.* **8**: 125–305.
- , AND S. PERRY. 1995. Photosynthetic pathway-related ultrastructure of C₃, C₄ and C₃-like C₃-C₄ intermediate sedges (Cyperaceae), with special reference to *Eleocharis*. *Austral. J. Pl. Physiol.* **22**: 1–10.
- , AND G. S. SMITH. 2002. *Eleocharis* R. Brown (subg. *Eleocharis* sect. *Eleocharis*) ser. *Tenuissimae* Svenson, pp. 90–99. In *Flora of North America* Editorial Committee [eds.], *Flora of North America*, Vol. 23. Oxford University Press, New York, USA.
- , N. E. STONE, AND P. W. HATTERSLEY. 1987. C₄ acid decarboxylation enzymes and anatomy in sedges (Cyperaceae): first record of NAD-malic enzyme species. *Austral. J. Pl. Physiol.* **14**: 719–728.
- , L. WATSON, AND M. J. DALLWITZ. 1992. Genera of Cyperaceae: interactive identification and information retrieval. *Taxon* **41**: 225–234.
- CAROLIN, R. C., S. W. L. JACOBS, AND M. VESK. 1977. The ultrastructure of Kranz cells in the family Cyperaceae. *Bot. Gaz.* **138**: 413–419.
- CHEN, T. M., R. H. BROWN, AND C. C. BLACK. 1970. CO₂ compensation concentration, rate of photosynthesis, and carbonic anhydrase activity of plants. *Weed Sci.* **18**: 399–403.
- , P. DITTRICH, W. H. CAMPBELL, AND C. C. BLACK. 1974. Metabolism of epidermal tissues, mesophyll cells, and bundle sheath strands resolved from mature nutsedge leaves. *Arch. Biochem. Biophys.* **163**: 246–262.
- CHERMEZON, H. 1926. Sur la feuille de certaines espèces de *Scleria*. *Rev. Gén. Bot.* **38**: 337–353.
- . 1930. Structure de la feuille et de la tige chez *Eriospora setifera*. *Arch. Bot.* **4**: 41–59.
- . 1933. Observations sur le genre *Microdracoides*. *Bull. Soc. Bot. France* **80**: 90–97.
- CLARKE, C. B. 1908. New genera and species of Cyperaceae. *Bull. Misc. Inform. Kew* **8**: 1–196.
- COLLINS, R. P., AND M. B. JONES. 1985. The influence of climatic factors on the distribution of C₄ species in Europe. *Vegetatio* **64**: 121–129.
- DENTON, M. F. 1983. Anatomical studies of the *Luzulae* group of *Cyperus* (Cyperaceae). *Syst. Bot.* **8**: 250–262.
- DHOOGHE, S., AND P. GOETGHEBEUR. 2002. A new Andean species and a new combination in *Oreobolopsis* (Cyperaceae). *Novon* **12**: 338–342.
- , AND A. M. MUASYA. 2003. *Zameioscirpus*, a new genus of Cyperaceae from South America. *Pl. Syst. Evol.* **243**: 73–84.
- DOWNTON, W. J. S., AND E. B. TREGUNNA. 1968. Carbon dioxide compensation—its relation to photosynthetic carboxylation reactions, systematics of the Gramineae, and leaf anatomy. *Canad. J. Bot.* **46**: 207–215.
- DRUYTS-VOETS, E. 1970. Types van stengel: en bladstructuren in het genus *Cyperus* L. *Natuurw. Tijdschr. Ned.-Indië* **52**: 28–49.
- EHLERINGER, J. R., Z. F. LIN, C. B. FIELD, G. C. SUN, AND C. Y. KUO. 1987. Leaf carbon isotope ratios of plants from a subtropical monsoon forest. *Oecologia* **72**: 109–114.
- EITEN, L. T. 1969. The vegetative anatomy of *Eleocharis interstincta* (Vahl) Roem. et Schult. *Arq. Bot. Estado São Paulo* **4**: 187–228.
- . 1976. The morphology of some critical Brazilian species of Cyperaceae. *Ann. Missouri Bot. Gard.* **63**: 113–199.
- ELLERY, K., W. N. ELLERY, AND B. T. VERHAGEN. 1992. The distribution of C₃ and C₄ plants in a successional sequence in the Okavango Delta. *S. African J. Bot.* **58**: 400–402.
- FREY, W., AND H. KÜRSCHNER. 1983. Photosyntheseweg und Zonierung von Halophyten an Salzseen in der Türkei, in Jordanien und im Iran. *Flora* **173**: 293–310.
- GETLIFFE NORRIS, F. M. 1983. Anatomy of the genus *Kyllinga* in South Africa. *Bothalia* **14**: 809–814.
- GHAMKHAR, K., A. MARCHANT, K. L. WILSON, AND J. J. BRUHL. 2007. Phylogeny of Abildgaardieae (Cyperaceae) inferred from ITS and *trnL-F* data, pp. 149–164. In J. T. Columbus, E. A. Friar, J. M. Porter, L. M. Prince, and M. G. Simpson [eds.], *Monocots: comparative biology and evolution—Poales*. Rancho Santa Ana Botanic Garden, Claremont, California, USA.
- GILLILAND, M. G., AND K. D. GORDON-GRAY. 1978. Kranz and non-Kranz cells in Cyperaceae. *Proceedings of the Electron Microscopy Society of Southern Africa* **8**: 85–86.
- GOETGHEBEUR, P. 1986. Genera Cyperacearum. Een bijdrage tot de kennis van de morfologie, systematiek en fylogenie van de Cyperaceae-genera. Ph.D. thesis, Rijksuniversiteit Gent, Belgium. 1164 pp. [In Flemish.]
- . 1998. Cyperaceae, pp. 141–190. In K. Kubitzki, H. Huber, P. J. Rudall, P. S. Stevens, and T. Stuetzel [eds.], *The families and genera of vascular plants*, Vol. 4. Springer-Verlag, Berlin, Germany.
- GOLDBLATT, P., P. C. HOCH, AND L. M. MCCOOK. 1992. Documenting scientific data: the need for voucher specimens. *Ann. Missouri Bot. Gard.* **79**: 969–970.
- GORDON-GRAY, K. D. 1971. *Fimbristylis* and *Bulbostylis*: generic limits as seen by a student of southern African species. *Mitt. Bot. Staatssamml. München* **10**: 549–574.
- GOVINDARAJALU, E. 1966. The systematic anatomy of South Indian Cyperaceae: *Bulbostylis* Kunth. *Bot. J. Linn. Soc.* **59**: 289–304.
- . 1969a. The systematic anatomy of South Indian Cyperaceae: *Fuirena* Rottb. *Bot. J. Linn. Soc.* **62**: 27–40.
- . 1969b. The systematic anatomy of South Indian Cyperaceae: *Cyperus* L. subgen. *Kyllinga* (Rottb.) Suringar. *Bot. J. Linn. Soc.* **62**: 41–58.
- . 1974. The systematic anatomy of South Indian Cyperaceae: *Cyperus* L. subgen. *Juncellus*, *Cyperus* subgen. *Mariscus* and *Lipocarpha* R. Br. *Bot. J. Linn. Soc.* **68**: 235–266.
- . 1975a. The systematic anatomy of South Indian Cyperaceae: *Eleocharis* R. Br., *Rhynchospora* Vahl and *Scleria* Bergius. *Adansonia* **14**: 581–632.
- . 1975b. Studies in Cyperaceae. XIV. Endomorphic evidence for placing *Cyperus hyalinus* under the new subgenus *Queenlandiella*. *Reinwardtia* **9**: 187–195.
- . 1976. The systematic anatomy of South Indian Cyperaceae: *Scirpus* L. s. lat. *Adansonia* **16**: 13–38.
- . 1978. The systematic anatomy of South Indian Cyperaceae: *Pycreus* (P. Beauv.) C. B. Clarke. *Adansonia* **18**: 95–128.
- . 1981. Studies in Cyperaceae. 19. Novelty in *Lipocarpha*: *L. raynaleana* and its vegetative anatomy. *Adansonia* **20**: 369–375.
- . 1985. Studies in Cyperaceae. 19. Species novarum Cyperacearum in memoriam optimi Professori Swamy. *Proc. Indian Acad. Sci., Pl. Sci.* **94**: 11–31.
- . 1990a. Cyperaceae Indiae Australis Precursores—nova species in *Fimbristyle* (L.) Vahl and their vegetative anatomy. *Proc. Indian Acad. Sci., Pl. Sci.* **100**: 77–84.
- . 1990b. Cyperaceae Indiae Australis Precursores: a novelty in *Cyperus* Linn. and its vegetative anatomy. *Proc. Indian Acad. Sci., Pl. Sci.* **100**: 409–413.
- , AND J. RAYNAL. 1976. Notes cypérologiques. 28. Compléments sur le genre *Rikliella* J. Rayn. *Adansonia* **16**: 219–228.
- GUAGLIANONE, E. R. 1990. Una especie nueva de *Cyperus* (Cyperaceae) de Misiones Argentina. *Darwiniana* **30**: 233–236.
- , AND O. UENO. 1990. A disjunct species in *Eleocharis* (Cyperaceae). *Darwiniana* **30**: 223–229.
- , AND B. RUTHSATZ. 1998. Note on *Eleocharis tucumanensis* (Cyperaceae). *Darwiniana* **35**: 169–173.
- HABERLANDT, G. 1882. Vergleichende Anatomie des assimilatorischen Gewebesystems der Pflanzen. *Jahrb. Wiss. Bot.* **13**: 74–188.
- . 1884. *Physiological plant anatomy. Today and Tomorrow's Book Agency, New Delhi, India.* 777 pp.

- HAINES, R. W., AND K. A. LYE. 1983. The sedges and rushes of East Africa. East African Natural History Society, Nairobi, Kenya. 404 pp.
- HATTERSLEY, P. W. 1987. Variations in photosynthetic pathway, pp. 49–64. In T. R. Soderstrom, K. W. Hilu, C. S. Campbell, and M. E. Barkworth [eds.], Grass systematics and evolution. Smithsonian Institution Press, Washington, D.C., USA.
- , AND L. WATSON. 1975. Anatomical parameters for predicting photosynthetic pathways of grass leaves: The “maximum lateral cell count” and the “maximum cells distant count”. *Phytomorphology* **25**: 325–333.
- , ———, AND C. B. OSMOND. 1977. *In situ* immunofluorescent labelling of ribulose-1,5-bisphosphate carboxylase in leaves of C₃ and C₄ plants. *Austral. J. Pl. Physiol.* **4**: 523–539.
- , S.-C. WONG, S. PERRY, AND Z. ROKSANDIC. 1986. Comparative ultrastructure and gas exchange characteristics of the C₃-C₄ intermediate *Neurachne minor* S. T. Blake (Poaceae). *Pl. Cell Environ.* **9**: 217–233.
- HAYASAKA, E. 2002. Taxonomic revision of the genus *Schoenoplectus* (Cyperaceae), with special reference to nutlet micromorphology. Ph.D. thesis, Tohoku University, Sendai, Japan. 325 pp.
- HESLA, B. L., L. L. TEISZEN, AND S. K. IMBAMBA. 1982. A systematic survey of C₃ and C₄ photosynthesis in the Cyperaceae of Kenya, East Africa. *Photosynthetica* **16**: 196–205.
- HNATIUK, R. J. 1980. C₄ photosynthesis in the vegetation of Aldabra Atoll. *Oecologia* **44**: 327–334.
- HOFSTRA, J. J., S. AKSORNKOAE, S. ATMOWIDJOJO, J. F. BANAAG, SANTOSA, R. A. SASTROHOETOMO, AND L. T. N. THU. 1972. A study on the occurrence of plants with a low CO₂ compensation point in different habitats in the tropics. *Ann. Bogor.* **5**: 143–157.
- HOSKING, J. R., G. R. SAINTY, AND S. W. L. JACOBS. 1996. Certainty and uncertainty in plant identification, pp. 464–467. In R. C. H. Shepherd [ed.], Proceedings of the Eleventh Australian Weeds Conference. Weed Science Society, Frankston, Victoria, Australia.
- IMAI, K., AND Y. MURATA. 1979. Changes in apparent photosynthesis, CO₂ compensation point and dark respiration of leaves of some Poaceae and Cyperaceae species with senescence. *Pl. Cell Physiol.* **20**: 1653–1658.
- JONES, M. B., G. E. HANNON, AND M. D. COFFEY. 1981. C₄ photosynthesis in *Cyperus longus* L., a species occurring in temperate climates. *Pl. Cell Environ.* **4**: 161–168.
- , AND T. R. MILBURN. 1978. Photosynthesis in papyrus (*Cyperus papyrus* L.). *Photosynthetica* **12**: 197–199.
- KALAPOUS, T., A. BALOGHNE-NYAKAS, AND P. CSONTOS. 1997. Occurrence and ecological characteristics of C₄ dicot and Cyperaceae species in the Hungarian flora. *Photosynthetica* **33**: 227–240.
- KEELEY, J. E., L. STERNBERG, AND M. J. DENIRO. 1986. The use of stable isotopes in the study of photosynthesis in freshwater plants. *Aquatic Bot.* **26**: 213–223.
- KÖRNER, C., G. D. FARQUHAR, AND Z. ROKSANDIC. 1988. A global survey of carbon isotope discrimination in plants from high altitude. *Oecologia* **74**: 623–632.
- KOYAMA, T. 1966. The systematic significance of leaf structure in the Cyperaceae–Mapanieae. *Mem. New York Bot. Gard.* **15**: 136–159.
- . 1967. The systematic significance of leaf structure in the tribe Sclerieae (Cyperaceae). *Mem. New York Bot. Gard.* **16**: 46–70.
- , AND E. R. GUAGLIANONE. 1987. *Oreobolopsis*: a new genus of Cyperaceae (Scirpeae) from Bolivia, South America. *Darwiniana* **28**: 79–85.
- KRENZER, E. G. J., D. N. MOSS, AND R. K. CROOKSTON. 1975. Carbon dioxide compensation points of flowering plants. *Pl. Physiol. (Lancaster)* **56**: 194–206.
- KÜKENTHAL, G. 1935. Cyperaceae–*Scirpoideae*–*Cypereae* 1, pp. 1–160. In A. Engler [ed.], Das Pflanzenreich, Heft 101. W. Engelmann, Berlin, Germany.
- . 1936. Cyperaceae–*Scirpoideae*–*Cypereae* 2, pp. 161–671. In A. Engler [ed.], Das Pflanzenreich, Heft 101. W. Engelmann, Berlin, Germany.
- KUKKONEN, I. 1967. Vegetative anatomy of *Uncinia* (Cyperaceae). *Ann. Bot. (Oxford)* **31**: 523–544.
- . 1970. Vegetative anatomy of *Carex microglochis* Wahlenb. and *Carex camptoglochis* Kreh. *Bot. J. Linn. Soc.* **63** (suppl. 1): 137–145.
- . 1995. (1192–1193) Two proposals to conserve species names in Cyperaceae. *Taxon* **44**: 625–627.
- , AND K. A. LYE. 1996. *Cyperus medusaeus* (Cyperaceae) redescribed. *Ann. Bot. Fenn.* **33**: 21–27.
- KUOH, C.-S., AND S.-H. T. CHIANG. 1984. The comparative leaf anatomy of the genus *Fimbristylis* (Cyperaceae). *Yushania* **1**: 29–43.
- LERMAN, J. C., AND J. RAYNAL. 1972. La teneur en isotopes stables du carbone chez les Cypéacées: sa valeur taxonomique. *Compt. Rend. Hebd. Séances Acad. Sci., Sér. D* **275**: 1391–1394.
- LI, M. 1993. Distribution of C₃ and C₄ species of *Cyperus* in Europe. *Photosynthetica* **28**: 119–126.
- , AND M. B. JONES. 1994. Kranzketten, a unique C₄ anatomy occurring in *Cyperus japonicus* leaves. *Photosynthetica* **30**: 117–131.
- , D. A. WEDIN, AND L. L. TIESZEN. 1999. C₃ and C₃ photosynthesis in *Cyperus* (Cyperaceae) in temperate eastern North America. *Canad. J. Bot.* **77**: 209–218.
- LIN, C. H., Y. S. TAI, D. J. LIU, AND M. S. B. KU. 1993. Photosynthetic mechanisms of weeds in Taiwan. *Austral. J. Pl. Physiol.* **20**: 757–769.
- MANI, A. P. 1963. Leaf anatomy in the identification of *Cyperus* species. *Trans. Bose Res. Inst., Calcutta* **26**: 119–128.
- MATEU ANDRES, I. 1991. Leaf anatomy of plants from coastal Mediterranean salt marshes. Monocotyledons. *Candollea* **46**: 345–358.
- MCCAUGHTON, S. J., L. L. WALLACE, AND M. B. COUGHENOUR. 1983. Plant adaptation in an ecosystem context: effects of defoliation, nitrogen and water on growth of an African C₄ sedge. *Ecology* **64**: 307–318.
- MEINZER, F. C. 1978. Observation on the taxonomic and ecologic distribution of C₄ carbon photosynthesis in vegetation of north-west Central America. *Revista Biol. Trop.* **26**: 359–369.
- METCALFE, C. R. 1971. Cyperaceae, pp. 260–261. In C. R. Metcalfe [ed.], Anatomy of the monocotyledons, Vol. 5. Clarendon Press, Oxford, UK. 597 pp.
- MOSS, D. N., E. G. J. KRENZER, AND W. A. BRUN. 1969. Carbon dioxide compensation points in related plant species. *Science* **164**: 187–188.
- MUASYA, A., J. J. BRUHL, D. A. SIMPSON, A. CULHAM, AND M. W. CHASE. 2000. Suprageneric phylogeny of Cyperaceae, pp. 593–601. In K. L. Wilson and D. A. Morrison [eds.], Monocots: systematics and evolution. CSIRO Publishing, Collingwood, Victoria, Australia.
- , D. A. SIMPSON, AND M. W. CHASE. 2002. Phylogenetic relationships in *Cyperus* L. s.l. (Cyperaceae) inferred from plastid DNA sequence data. *Bot. J. Linn. Soc.* **138**: 145–153.
- , ———, ———, AND A. CULHAM. 1998. An assessment of suprageneric phylogeny in Cyperaceae using *rbcL* DNA sequences. *Pl. Syst. Evol.* **211**: 257–271.
- MULROY, T. W., AND P. W. RUNDEL. 1977. Annual plants: adaptations to desert environments. *Bioscience* **27**: 109–114.
- NAUTIYAL, D. D., AND B. K. DAS. 1982. Contributions to the anatomy of Cyperaceae. I: *Cyperus tenuispica* Steud. *Phyta, Studies on Living & Fossil Plants, Pant Commem. Vol.*, pp. 173–197.
- PONESSA, G., M. TORRES, AND L. BENÍTEZ. 1997. Estudio taxonómico de *Scirpus* sección *Monocephales* (Cyperaceae) en Tucumán, República Argentina. *Lilloa* **39**: 5–30.
- PRAKASH, N., T. C. SHEN, K. C. YAP, AND K. M. YIM. 1976. A survey of the leaf structure and its relationship to the photosynthetic pathways in certain Malaysian plants. *Malaysian J. Sci.* **4**: 67–73.

- RAGHAVENDRA, A. S., AND S. R. DAS. 1976. Distribution of the C₄ dicarboxylic acid pathway of photosynthesis in local monocotyledonous plants and its taxonomic significance. *New Phytol.* **76**: 301–305.
- RAYNAL, J. 1972. La teneur en isotopes stables du carbone chez les Cypéracées: sa valeur taxonomique. *Compt. Rend. Hebd. Séances Acad. Sci., Sér. D* **275**: 1391–1394.
- . 1973. Notes cypérologiques. 19. Contribution à la classification de la sous-famille des Cyperoideae. *Adansonia* **13**: 145–171.
- RIKLI, M. 1895. Beiträge zur vergleichenden Anatomie der Cyperaceen mit besonderer Berücksichtigung der inneren Parenchym-scheide. *Jahrb. Wissensch. Bot.* **27**: 485.
- ROALSON, E. H., AND E. A. FRIAR. 2000. Infrageneric classification of *Eleocharis* (Cyperaceae) revisited: evidence from the internal transcribed spacer (ITS) region of nuclear ribosomal DNA. *Syst. Bot.* **25**: 323–336.
- RODRIGUES, A. C., AND M. E. M. ESTELITA. 2003. Origin and structure of the Kranz tissue in bracts of *Cyperus giganteus* Vahl (Cyperaceae). *Revista Brasil. Bot.* **26**: 445–452.
- SABNIS, T. S. 1921. The physiological anatomy of the plants of the Indian Desert. *J. Indian Bot.* **2**: 163–299.
- SAGE, R. F. 2002. C₄ photosynthesis in terrestrial plants does not require Kranz anatomy. *Trends Pl. Sci.* **7**: 283–285.
- , M. LI, AND R. K. MONSON. 1999. The taxonomic distribution of C₄ photosynthesis, pp. 551–584. In R. F. Sage and R. K. Monson [eds.], C₄ plant biology. Academic Press, San Diego, California, USA.
- SAXENA, K. G., AND P. S. RAMAKRISHNAN. 1984. C₃/C₄ species distribution among successional herbs following slash and burn in north-eastern India. *Acta Oecologica* **5**: 335–346.
- SHARMA, O. P. 1972. Anatomy of *Scirpus squarrosus* L. *Curr. Sci.* **41**: 494–497.
- . 1973. Anatomy of *Eriophorum comosum*. *Phytomorphology* **23**: 17–24.
- , AND P. N. MEHRA. 1970. Comparative anatomy of *Kobresia* Willd. (Cyperaceae). *Res. Bull. Punjab Univ., New Ser., Sci.* **21**: 119–128.
- , AND ———. 1972. Systematic anatomy of *Fimbristylis* Vahl (Cyperaceae). *Bot. Gaz.* **133**: 87–95.
- SHEPHERD, G. J. 1976. The use of anatomical characters in the intrageneric classification of *Carex* (Cyperaceae). *Hoehnea* **6**: 33–54.
- SIMPSON, D. 1990. A revision of *Cyperus* sect. *Leucocephali*. *Kew Bull.* **45**: 485–501.
- SIMPSON, D. A., A. M. MUASYA, K. CHAYAMARIT, J. A. N. PARNELL, S. SUDDÉE, B. D. E. WILDE, M. B. JONES, J. J. BRUHL, AND R. POOMA. 2005. *Khaosokia caricoides*, a new genus and species of Cyperaceae from Thailand. *Bot. J. Linn. Soc.* **149**: 357–364.
- SMITH, B. N., AND S. EPSTEIN. 1971. Two categories of ¹³C/¹²C ratios for higher plants. *Pl. Physiol. (Lancaster)* **47**: 380–384.
- SMITH, G. S., C. M. JOHNSTON, AND I. S. CORNFORTH. 1983. Comparison of nutrient solutions for growth of plants in sand culture. *New Phytol.* **94**: 537–548.
- SONNENBERG, B. J., AND C. E. J. BOTHA. 1992. An investigation of leaf-blade anatomy and photosynthetic characteristics of four Cyperaceae species from the Albany and Bathurst districts in the eastern Cape. *S. Afr. J. Bot.* **58**: 297–303.
- SOROS, C. L., AND J. J. BRUHL. 2000. Multiple evolutionary origins of C₄ photosynthesis in the Cyperaceae, pp. 629–636. In K. L. Wilson and D. A. Morrison [eds.], Monocots: systematics and evolution. CSIRO Publishing, Collingwood, Victoria, Australia.
- , AND N. G. DENGLER. 2001. Ontogenetic derivation and cell differentiation in photosynthetic tissues of C₃ and C₄ Cyperaceae. *Amer. J. Bot.* **88**: 992–1005.
- STANDLEY, L. A. 1987a. Anatomical and chromosomal studies of *Carex* section *Phacocystis* in eastern North America. *Bot. Gaz.* **148**: 507–518.
- . 1987b. Anatomical studies of *Carex cuchumatanaensis*, *C. decidua* and *C. hermannii* (Cyperaceae) and comparisons with North American taxa of the *C. acuta* complex. *Brittonia* **39**: 11–19.
- . 1990. Anatomical aspects of the taxonomy of sedges (*Carex*, Cyperaceae). *Canad. J. Bot.* **68**: 1449–1456.
- STERNBERG, L., M. J. DENIRO, AND J. E. KEELEY. 1984. Hydrogen, oxygen, and carbon isotope ratios of cellulose from submerged aquatic crassulacean acid metabolism and non-crassulacean acid metabolism plants. *Pl. Physiol. (Lancaster)* **76**: 68–70.
- STOCK, W. D., D. K. CHUBA, AND G. A. VERBOOM. 2004. Distribution of South African C₃ and C₄ species of Cyperaceae in relation to climate and phylogeny. *Austral Ecol.* **29**: 313–319.
- SVENSON, H. K. 1937. Monographic studies in the genus *Eleocharis*. IV. *Rhodora* **39**: 236–273.
- . 1939. Monographic studies in the genus *Eleocharis*. V. *Rhodora* **41**: 73–77.
- SYVERTSEN, J. P., G. L. NICKELL, R. W. SPELLENBERG, AND G. L. CUNNINGHAM. 1976. Carbon reduction pathways and standing crop in three Chihuahuan desert plant communities. *Southwestern Naturalist* **21**: 311–320.
- TAKEDA, T., O. UENO, AND W. AGATA. 1980. The occurrence of C₄ species in the genus *Rhynchospora* and its significance in Kranz anatomy of the Cyperaceae. *Bot. Mag. (Tokyo)* **93**: 55–65.
- , M. SAMEJIMA, AND T. OHTANI. 1985. An investigation for the occurrence of C₄ photosynthesis in the Cyperaceae from Australia. *Bot. Mag. (Tokyo)* **98**: 393–411.
- THOMAS, W. W. 1984. The systematics of *Rhynchospora* sect. *Dichromena*. *Mem. New York Bot. Gard.* **37**: 1–116.
- TREGUNNA, E. B., B. N. SMITH, J. A. BERRY, AND W. J. S. DOWNTON. 1970. Some methods for studying the photosynthetic taxonomy of the angiosperms. *Canad. J. Bot.* **48**: 1209–1214.
- TROUGHTON, J. H., K. A. CARD, AND C. H. HENDY. 1974. Photosynthetic pathways and carbon isotope discrimination by plants. *Yearb. Carnegie Inst. Washington* **73**: 768–780.
- UCHINO, A., M. SAMEJIMA, R. ISHII, AND O. UENO. 1995. Photosynthetic carbon metabolism in an amphibious sedge, *Eleocharis baldwinii* (Torr.) Chapm.: modified expression of C₄ characteristics under submerged aquatic conditions. *Pl. Cell Physiol.* **36**: 229–238.
- UENO, O. 1996. Structural characterization of photosynthetic cells in an amphibious sedge, *Eleocharis vivipara*, in relation to C₃ and C₄ metabolism. *Planta* **199**: 382–393.
- . 1998a. Immunogold localization of photosynthetic enzymes in leaves of various C₄ plants, with particular reference to pyruvate orthophosphate dikinase. *J. Exper. Bot.* **49**: 1637–1646.
- . 1998b. Induction of Kranz anatomy and C₄-like biochemical characteristics in a submerged amphibious plant by abscisic acid. *Pl. Cell* **10**: 571–583.
- . 2001. Environmental regulation of C₃ and C₄ differentiation in the amphibious sedge *Eleocharis vivipara*. *Pl. Physiol. (Lancaster)* **127**: 1524–1532.
- . 2004. Environmental regulation of photosynthetic metabolism in the amphibious sedge *Eleocharis baldwinii* and comparisons with related species. *Pl. Cell Environm.* **27**: 627–639.
- , AND K. ISHIMARU. 2002. Effects of an inhibitor of phosphoenolpyruvate carboxylase on photosynthesis of the terrestrial forms of amphibious *Eleocharis* species. *Photosyn. Res.* **71**: 265–272.
- , AND Y. KOBAYASHI. 2002. Cellular regulation of glycine decarboxylase in the amphibious C₃/C₄ sedge, *Eleocharis vivipara*. *Pl. Cell Physiol.* **43**: S173–S174.
- , AND T. KOYAMA. 1987. Distribution and evolution of C₄ syndrome in *Rhynchospora* (Rhynchosporae: Cyperaceae). *Bot. Mag. (Tokyo)* **100**: 63–85.

- , AND M. SAMEJIMA. 1989. Structural features of NAD-Malic Enzyme Type C₄ *Eleocharis*: an additional report of C₄ acid decarboxylation types of the Cyperaceae. *Bot. Mag. (Tokyo)* **102**: 393–402.
- , AND ———. 1990. Immunogold localization of ribulose 1,5-bisphosphate carboxylase in amphibious *Eleocharis* species in relation to C₃ and C₄ photosynthesis. *Current Research in Photosynthesis* **4**: 867–870.
- , ———, AND T. KOYAMA. 1989. Distribution and evolution of C₄ syndrome in *Eleocharis*, a sedge group inhabiting wet and aquatic environments, based on culm anatomy and carbon isotope ratios. *Ann. Bot.* **64**.
- , ———, S. MUTO, AND S. MIYACHI. 1988a. Photosynthetic characteristics of an amphibious plant, *Eleocharis vivipara*: expression of C₄ and C₃ modes in contrasting environments. *Proc. Natl. Acad. Sci. U.S.A.* **85**: 6733–6737.
- , AND T. TAKEDA. 1992. Photosynthetic pathways, ecological characteristics, and the geographical distribution of the Cyperaceae in Japan. *Oecologia* **89**: 195–203.
- , ———, AND E. MAEDA. 1988b. Leaf ultrastructure of C₄ species possessing different Kranz anatomical types in the Cyperaceae. *Bot. Mag. (Tokyo)* **101**: 141–152.
- , ———, AND T. MURATA. 1986. C₄ acid decarboxylating enzyme activities of C₄ species possessing different Kranz anatomical types in the Cyperaceae. *Photosynthetica* **20**: 111–116.
- VORSTER, P. 1990. Anatomy of the South African species of *Marsipposiphon* (Cyperaceae), and its relation to environmental conditions. *Mitt. Inst. Allg. Bot. Hamburg* **23a**: 367–386.
- . 1996. Justification for the generic status of *Courtoisina* (Cyperaceae). *Bot. J. Linn. Soc.* **121**: 271–280.
- WANG, R. Z. 2003. C₄ plants in the vegetation of Tibet, China: their natural occurrence and altitude distribution pattern. *Photosynthetica* **41**: 21–26.
- WILLIAMS, G. J., AND R. K. MONSON. 1981. Gas exchange in *Carex stenophylla* and its relationship to leaf anatomy, pp. 11–21. In G. Akoyunoglou [ed.], *Photosynthesis VI. Photosynthesis and productivity, photosynthesis and environment*. Balaban International Science Services, Philadelphia, USA.
- WILLS, G. D. 1987. Description of purple and yellow nutsedge (*Cyperus rotundus* and *C. esculentus*). *Weed Technol.* **1**: 2–9.
- WILSON, K. L. 1981. Revision of the genus *Mesomelaena* (Cyperaceae). *Telopea* **2**: 181–195.
- . 1991. Systematic studies in *Cyperus* section *Pinnati* (Cyperaceae). *Telopea* **4**: 361–496.
- WINTER, K., AND J. H. TROUGHTON. 1978. Photosynthetic pathways in plants of coastal and inland habitats of Israel and the Sinai. *Flora. Abteilung A, Physiologie und Biochemie. Jena* **167**: 1–34.

APPENDIX 1: Published and Inferred Records of Photosynthetic Pathway Type in Cyperaceae

This list includes both previously published records of photosynthetic pathway type in species of Cyperaceae and newly published records.

Column 1: Species.—A taxon is listed by what the present authors believe is its currently accepted name. For previously published records, the name used in the original publication is indicated if different from the current name. The present authors have examined and confirmed or re-determined the vouchers concerned in some cases. For example, one of the vouchers for *Mesomelaena stygia* (Coveny 8296, NSW) cited by Takeda et al. (1985) is actually *M. preissii* (Wilson 1981). Similarly, Takeda et al. (1985) cited NT 42319 (*Henshall* 249) as *Cyperus angustatus*, but that specimen belongs to *C. fucosus* (voucher re-determined by KLW at NSW; Wilson 1991). For other records, the authors have updated the nomenclature from recent monographic and floristic works, as well as the draft World Checklist being coordinated by D. Simpson and R. Go-

vaerts, and by consulting other cyperologists (see Acknowledgments). This does not guarantee, of course, that the vouchers were correctly identified by the original researchers, so the vouchers should be reexamined in any critical cases.

Column 2: Photosynthetic pathway.—Pathway type is indicated as being C₃, C₄, or apparently intermediate or variable in some species. These types are inferred by the present authors from the analyses either quoted here for new records or given in previously published works. + = an anomalous record that is discussed in Appendix 2 or in the text.

Column 3: References.—References are to previously published and new records, which are treated differently.

Previously published records.—For these, the publication is cited, followed by the method by which the pathway type was assessed, using the abbreviations below, and as discussed in the main text. In some older publications that pre-date recognition of the significance of anatomical arrangements, we have inferred the pathway type from the anatomical sections illustrated—indicated by “[A]”. Actual values are not given here. For these, the reader should consult the original publications or the current authors’ database, which will be available on-line by the second half of 2006 (or by contacting one of the two authors).

- A = anatomy
- [A] = anatomy deduced from older publications
- c = chlorocyperoid anatomy
- e, [e] = eleocharoid anatomy
- f = fimbristylloid anatomy
- r = rhychosporoid anatomy
- B = biochemistry
- Γ = CO₂ compensation point (ml/liter or ppm CO₂)
- δ¹³C = δ¹³C values in ‰
- IL = immunofluorescence labelling of Rubisco
- ASP = aspartate as the initial product of photosynthesis
- MAL = malate as the initial product of photosynthesis
- NAD = NAD-malic enzyme (ME)
- NADP = NADP-ME
- PHOS = sugar phosphates as the initial products of photosynthesis
- PIB = post-illumination CO₂ burst effect
- US = ultrastructure
- S = submerged form of an *Eleocharis* species
- T = terrestrial form of an *Eleocharis* species

New records.—Records newly published here come from several sources. Many are from the current authors’ separate or joint research, indicated by “JB”, “KW” or “BW” (see abbreviations listed below). Records for *Phylloscirpus* are based on leaf sections cut by Sandra Dhooge (GENT) and interpreted by JB and KW. Records labelled as “LR” are the original analyses by J. C. Lerman and the late Jean Raynal in the early 1970s that were the basis of several publications (Lerman and Raynal 1972; Raynal 1972, 1973). Similarly, those labelled as “SCV” come from the work of W. D. Stock, D. K. Chuba, and G. A. Verboom and underlie their recent publication on South African species (Stock et al. 2004). See text for further discussion. All vouchers for new LR records are in P; all vouchers for SCV records are in BOL. The default herbarium is NSW for new records from Bruhl and Wilson; all other herbaria are indicated using the abbreviations in Index Herbariorum (current version accessible on the New York Botanical Garden website, www.nybg.org).

- JB = J. J. Bruhl, this study, including records listed in Bruhl (1990)
- KW = K. L. Wilson, this study
- BW = J. Bruhl and K. Wilson, this study
- BDW = J. Bruhl, S. Dhooge, and K. Wilson, this study
- LR = the records from J. C. Lerman and J. Raynal that underlaid Lerman and Raynal (1972) and Raynal (1972, 1973)
- SCV = the records from W. D. Stock, D. K. Chuba, and G. A. Verboom that underlay Stock et al. (2004).

Appendix 1. Published and inferred records of photosynthetic pathway type in Cyperaceae.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>Abildgaardia hygrophila</i> (Gordon-Gray) K. Lye	C ₃	JB (A: <i>Ward 2794</i> BRI, <i>5519</i> BRI. $\delta^{13}\text{C}$: -27.9, <i>Ward 2794</i> , -28.2, <i>Ward 5519</i>)
<i>A. macrantha</i> (Boeck.) ined., as <i>Fimbristylis macrantha</i> Boeck.	C ₄	Takeda et al. 1985 (Af)
<i>A. ovata</i> (Burm. f.) Kral, as <i>Fimbristylis monostachyos</i> (L.) Hassk. ^a , as <i>F. ovata</i> (Burm. f.) Kern ^b	C ₄	Gordon-Gray 1971 ([A]) ^b ; Sharma and Mehra 1972 ([A]) ^a ; Raghavendra and Das 1976 (A. F) ^a ; Carolin et al. 1977 (USf) ^b ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^b ; Kuoh and Chiang 1984 (A) ^b ; Bruhl et al. 1987 (Af. B) ^b ; LR ($\delta^{13}\text{C}$: -11.3, <i>Chevalier 22172</i>) ^b
<i>A. oxystachya</i> (F. Muell.) ined., as <i>Fimbristylis oxystachya</i> F. Muell.	C ₄	Takeda et al. 1985 (Af)
<i>A. schoenoides</i> R. Br., as <i>Fimbristylis squarrosula</i> F. Muell.	C ₄	Takeda et al. 1985 (Af. $\delta^{13}\text{C}$)
<i>A. triflora</i> (L.) Abeyw., as <i>Fimbristylis triflora</i> (L.) K. Schum. ^a	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; JB (Af: <i>Davidse 8228</i> BRI. $\delta^{13}\text{C}$: -10.6, <i>Davidse 8228</i>); LR ($\delta^{13}\text{C}$: -12.0, <i>Boivin s. n.</i>) ^a
<i>A. vaginata</i> R. Br., as <i>Fimbristylis brownii</i> Benth.	C ₄	Bruhl et al. 1987 (Af. B); JB (Af: <i>s. coll.</i> CANB 114505; <i>Bruhl 233, 236</i> CANB)
<i>Actinoschoenus filiformis</i> (Thwaites) Benth.	C ₃	JB (A: <i>Ramos</i> NSW 181450); LR ($\delta^{13}\text{C}$: -27.4, <i>Poilane 23085</i>)
<i>Actinoscirpus grossus</i> (L. f.) Goetgh. & D. A. Simpson, as <i>Hymenochaeta grossa</i> (L. f.) Nees ^a , as <i>Scirpus grossus</i> L. f. ^b	C ₃	Govindarajalu 1976 ([A]) ^b ; Takeda et al. 1985 (A) ^a ; JB (A: <i>Specht 1243</i> CANB)
<i>Afrotrilepis jaegeri</i> J. Raynal	C ₃	JB (A: <i>Jaeger 7869</i> NSW 181677)
<i>A. pilosa</i> (Boeck.) J. Raynal, as <i>Eriospora pilosa</i> (Boeck.) Benth. ^a	C ₃	Chermeson 1930 ([A]) ^a ; JB (A: <i>Letouzey 13915</i>); LR ($\delta^{13}\text{C}$: -32.3, <i>Hallé & Villiers 4978</i> , -33.1, <i>Serre Orsay</i> cult., 1972)
<i>Alinula lipocarphoides</i> (Kük.) J. Raynal	C ₄	JB (Ac: <i>Robinson 5018</i> EA)
<i>A. malawica</i> (J. Raynal) Goetgh. & Vorster, as <i>Mariscus malawicus</i> J. Raynal	C ₄	Raynal 1973 (A)
<i>A. paradoxa</i> (Cherm.) Goetgh. & Vorster	C ₃	SCV ($\delta^{13}\text{C}$: -25.08, <i>Burtt-Davy 1749</i>)
<i>A. peteri</i> (Kük.) Goetgh. & Vorster, as <i>Ascolepis peteri</i> Kük. ^a	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; JB (Ac: <i>Greenway 13488</i> EA); LR ($\delta^{13}\text{C}$: -14.1, <i>Robinson 4438</i>) ^a
<i>Amphiscirpus nevadensis</i> (S. Watson) Oteng-Yeboah	C ₃	JB (A: <i>Peck 15386</i> K)
<i>Androtrichum trigynum</i> (Spreng.) H. Pfeiff.	C ₃	JB (A: <i>Rosengurtx B3904</i> U); LR ($\delta^{13}\text{C}$: -27.5, <i>Hatschbach 15198</i>)
<i>Arthrostylis aphylla</i> R. Br.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: <i>Reeve 127</i> CANB); LR ($\delta^{13}\text{C}$: -27.4, <i>Leichhardt 33</i>)
<i>Ascolepis capensis</i> (Kunth) Ridl.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); JB (Ac: <i>Cooper</i> , Mar 1873, MEL 1543822); LR ($\delta^{13}\text{C}$: -12.4, <i>Meurillon CNAD 688</i>); SCV ($\delta^{13}\text{C}$: -10.31, <i>Bolus 3944</i>)
<i>A. dipsacoides</i> (K. Schum.) J. Raynal	C ₄	LR ($\delta^{13}\text{C}$: -10.3, <i>Annet 53</i>)
<i>A. pinguis</i> C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>A. protea</i> Welwitsch	C ₄	LR ($\delta^{13}\text{C}$: -10.4, <i>Letouzey 7567</i>)
<i>A. pusilla</i> Ridl.	C ₄	LR ($\delta^{13}\text{C}$: -11.4, <i>Demange 3276</i>)
<i>Asterochaete capitellata</i> Nees (<i>Carpha capitellata</i> (Nees) Boeck.)	C ₃	JB (A: MEL 1543862)
<i>Baumea acuta</i> (Labill.) Palla	C ₃	JB (A: <i>Newbey 4625</i> CANB)
<i>B. articulata</i> (R. Br.) S. T. Blake, as <i>Machaerina articulata</i> (R. Br.) Koyama	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$)
<i>B. deplanchei</i> Boeck.	C ₃	LR ($\delta^{13}\text{C}$: -30.4, <i>Raynal & Jaffré 16490</i>)
<i>B. glomerata</i> Gaud.	C ₃	JB (A: <i>van Royen 5218</i> CANB)
<i>B. juncea</i> (Nees) Boeck., as <i>Machaerina juncea</i> (R. Br.) Koyama	C ₃	Takeda et al. 1985 (A)
<i>B. rubiginosa</i> (Spreng.) Boeck., as <i>Machaerina nipponensis</i> (Ohwi) Ohwi & Koyama ^a , as <i>Machaerina rubiginosa</i> (Spreng.) Koyama ^b	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$) ^b ; Ueno et al. 1986 (A. B) ^a ; JB (A: <i>Bruhl 518</i> CANB)
<i>B. teretifolia</i> (R. Br.) Palla, as <i>Machaerina teretifolia</i> (R. Br.) Koyama	C ₃	Takeda et al. 1985 (A)
<i>B. tetragona</i> (Labill.) S. T. Blake	C ₃	KW (A: <i>Beauglehole 36048</i> ; <i>Sharpe 1365</i>)
<i>Becquerelia cymosa</i> Brongn. subsp. <i>cymosa</i>	C ₃	JB (A: <i>Harley 20171</i> K); LR ($\delta^{13}\text{C}$: -32.0, <i>Sastre 97</i>)
<i>Bisboeckelera irrigua</i> (Nees) Kuntze	C ₃	LR ($\delta^{13}\text{C}$: -36.6, <i>Smith 2785</i>)
<i>B. microcephala</i> (Boeck.) Koyama	C ₃	JB (A: <i>Florschuetz 1819</i> U)
<i>Blysmus compressus</i> (L.) Panz. ex Link	C ₃	JB (A: <i>Manchester 1387</i>); LR ($\delta^{13}\text{C}$: -27.5, <i>Duclos s. n.</i> , 1924)
<i>B. rufus</i> (Huds.) Link (<i>Blysmopsis rufa</i> (Huds.) Oteng-Yeboah)	C ₃	JB (A: <i>Stafleu 338</i> ; <i>Laurer</i> NSW 181496)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>Bolboschoenus</i> cf. <i>medianus</i> (V. J. Cook) Soják, as <i>Scirpus maritimus</i> L.	C ₃	Takeda et al. 1985 (A)
<i>B. fluviatilis</i> (Torr.) Soják, as <i>Scirpus fluviatilis</i> (Torr.) A. Gray ^a	C ₃	Takeda et al. 1985 (A) ^a ; Ueno et al. 1986 (A. B) ^a ; JB (A: <i>Gray 3921</i> CANB)
<i>B. maritimus</i> (L.) Palla, as <i>Scirpus maritimus</i> L. ^a	C ₃	Sabnis 1921 ([A]) ^a ; Govindarajalu 1976 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$); Mateu Andres 1991 ([A]) ^a ; LR ($\delta^{13}\text{C}$: -29.7 , <i>Perrotet 818</i>)
<i>B. robustus</i> (Pursh) Soják, as <i>Scirpus robustus</i> Pursh	C ₃	Bender 1971 ($\delta^{13}\text{C}$)
<i>Bulbostylis abortiva</i> (Steud.) C. B. Clarke	C ₄	LR ($\delta^{13}\text{C}$: -13.3 , <i>Tisserant 3161</i>)
<i>B. argenteobrunnea</i> C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>B. atrosanguinea</i> (Boeck.) C. B. Clarke	C ₄	Hesla et al. 1982 (A. $\delta^{13}\text{C}$)
<i>B. barbata</i> (Rottb.) C. B. Clarke	C ₄	Govindarajalu 1966 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (Af); Ueno et al. 1986 (Af. B); Ueno et al. 1988b (USf); Ueno and Takeda 1992 (A. G); JB (Af: <i>McKee 10720</i> CANB; <i>Bruhl 540</i> CANB)
<i>B. basalis</i> Fosberg	C ₄	Hnatiuk 1980 (A)
<i>B. boeckeleriana</i> (Schweinf.) Beetle	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$: -10.7)
<i>B. bozumensis</i> Cherm.	C ₄	LR ($\delta^{13}\text{C}$: -13.8 , <i>Badré 40</i>)
<i>B. coleotricha</i> (Hochst. ex A. Rich.) C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -12.5 , <i>Pobéguin 408</i>)
<i>B. contexta</i> (Nees) Bodard	C ₄	Gordon-Gray 1971 ([A])
<i>B. densa</i> (Wall. ex Roxb.) Hand.-Mazz., as <i>B. capillaris</i> (L.) C. B. Clarke subsp. <i>trifida</i> (Nees) Koyama ^a , as <i>B. capillaris</i> var. <i>trifida</i> (Nees) C. B. Clarke ^b	C ₄	Govindarajalu 1966 ([A]) ^b ; Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (Af. $\delta^{13}\text{C}$); Ueno and Takeda 1992 (A) ^a
subsp. <i>afrimontana</i> (K. Lye) R. Haines, as <i>B. capillaris</i>	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>B. filamentosa</i> (Vahl) C. B. Clarke, as <i>B. cardiocarpa</i> (Ridl.) C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>B. hispidula</i> subsp. <i>filiformis</i> (C. B. Clarke) R. Haines, as <i>B. filiformis</i> C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>B. glaberrima</i> Kük.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>B. hispidula</i> (Vahl) R. W. Haines, as <i>Fimbristylis hispidula</i> (Vahl) Kunth	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -13.4 , <i>Chevalier 9243</i>)
<i>B. humilis</i> (Kunth) C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>B. lanata</i> (Kunth) Lindm.	C ₄	JB (Af: <i>McKee 10720</i> CANB)
<i>B. laniceps</i> C. B. Clarke	C ₄	LR ($\delta^{13}\text{C}$: -14.1 , <i>Chevalier 27599</i>)
<i>B. lanifera</i> (Boeck.) Kük.	C ₄	LR ($\delta^{13}\text{C}$: -12.6 , <i>Berhaut 2617</i>)
<i>B. mucronata</i> C. B. Clarke	C ₄	LR ($\delta^{13}\text{C}$: -10.6 , <i>Humbert 15943</i>)
<i>B. oligostachys</i> (Hochst. ex A. Rich.) K. Lye, as <i>Fimbristylis oligostachys</i> Hochst. ex A. Rich.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>B. oritrephes</i> (Ridl.) K. Lye	C ₄	LR ($\delta^{13}\text{C}$: -12.0 , <i>Letouzey 8733</i>)
<i>B. paradoxa</i> (Spreng.) Lindm.	C ₄	JB (Af ² , <i>McKee 11199</i> CANB)
<i>B. pilosa</i> (Willd.) Cherm.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -12.0 , <i>Boivin s. n.</i> , 1850)
<i>B. puberula</i> (Poir.) C. B. Clarke var. <i>gracilis</i> (Nees) Fisch.	C ₄	Govindarajalu 1966 ([A])
var. <i>puberula</i> , as <i>B. puberula</i>	C ₄	Govindarajalu 1966 ([A])
<i>B. pusilla</i> (Hochst. ex A. Rich.) C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -16.0 , <i>Le Testu 2868</i>)
<i>B. schimperiana</i> (A. Rich.) C. B. Clarke, as <i>Fimbristylis humilis</i> A. Peter	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>B. subspinescens</i> C. B. Clarke	C ₄	Govindarajalu 1966 ([A])
<i>B. swamyi</i> Govindarajalu	C ₄	Govindarajalu 1985 ([A])
<i>B. trichobasis</i> (Baker) C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>B. turbinata</i> S. T. Blake	C ₄	Takeda et al. 1985 (Af. $\delta^{13}\text{C}$)
<i>B. vanderystii</i> Cherm.	C ₄	LR ($\delta^{13}\text{C}$: -11.3 , <i>Chevalier 27314</i>)
<i>Calyptrocarya glomerulata</i> (Brongn.) Urb.	C ₃	JB (Af: <i>Campbell</i> MEL 1543844; <i>Harris 438</i> K); LR ($\delta^{13}\text{C}$: -37.2 , <i>Pinto & Sastre 971</i>)
<i>Capeobolus brevicaulis</i> (C. B. Clarke) J. Browning	C ₃	JB (A: <i>Bruhl 1720, 1736</i> NE; <i>Moss 7612</i> K)
<i>Capitularina involucreta</i> (Valck. Sur.) Kern	C ₃	JB (A: <i>van Royen 4005</i> CANB); LR ($\delta^{13}\text{C}$: -33.8 , <i>Hombroon s. n.</i> , 1841)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>Carex alligata</i> Boott, as <i>C. sandwichensis</i> [sic] Boeck.	C ₃	Standley 1990 ([A])
<i>C. appressa</i> R. Br.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: <i>Bruhl 119</i> CANB; <i>Bruhl 15</i> CANB); LR ($\delta^{13}\text{C}$: -24.6, <i>Drummond 272</i>)
<i>C. baccans</i> Nees	C ₃	Hofstra et al. 1972 (A. Γ)
<i>C. bequaertii</i> De Wild.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. bohemica</i> Schreb., as <i>C. cyperoides</i> L.	C ₃	LR ($\delta^{13}\text{C}$: -27.7, <i>Duclos s. n.</i> , 1929)
<i>C. breviculmis</i> R. Br.	C ₃	Takeda et al. 1985 (A)
<i>C. camptoglochin</i> Krech.	C ₃	Kukkonen 1970 ([A])
<i>C. capillacea</i> Boott	C ₃	JB (A: <i>Adams 2619</i> CANB)
<i>C. castanostachya</i> K. Schum.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. cephalotes</i> F. Muell.	C ₃	JB (A: <i>Doing</i> , 8 Jan 1964 CANB; <i>Gray 4785</i> CANB)
<i>C. chlorosaccus</i> C. B. Clarke	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. collumanthus</i> (Steyerm.) L. E. Mora (<i>Vesicarex collumanthus</i> Steyerm.)	C ₃	JB (A: <i>Cleef 5611</i> U)
<i>C. conferta</i> Hochst. ex A. Rich.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
var. <i>lycurus</i> (K. Schum.) K. Lye, as <i>C. lycurus</i> K. Schum.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. cruciata</i> Vahl	C ₃	Saxena and Ramakrishnan 1984 (A)
<i>C. cuchumatensis</i> Standley & Steyerm.	C ₃	Standley 1987b ([A]); Standley 1990 ([A])
<i>C. curvula</i> Allioni	C ₃	Körner et al. 1988 ($\delta^{13}\text{C}$)
<i>C. decida</i> Boott	C ₃	Standley 1987b ([A])
<i>C. declinata</i> Boott	C ₃	Takeda et al. 1985 (A)
<i>C. dietrichiae</i> Boeck.	C ₃	LR ($\delta^{13}\text{C}$: -31.7, <i>Schlechter 18277</i>)
<i>C. doniana</i> Spreng., as <i>C. japonica</i> Thunb. subsp. <i>chlorostachys</i> (D. Don) Koyama	C ₃	Ueno et al. 1986 (A. B)
<i>C. duriuscula</i> C. A. Mey., as <i>C. eleocharis</i> L. H. Bailey	C ₃	Boutton et al. 1980 (A)
<i>C. echinochloe</i> Kunze	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. elgonensis</i> Nelmes	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. emoryi</i> Dewey	C ₃	Standley 1987a ([A])
<i>C. ericetorum</i> Pollich	C ₃	LR ($\delta^{13}\text{C}$: -25.9, <i>Lerman s. n.</i> , 1970)
<i>C. erythrorrhiza</i> Boeck.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. extensa</i> Good.	C ₃	Mateu Andres 1991 ([A])
<i>C. fascicularis</i> Solander ex Boott	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: <i>Gray 5825</i> CANB)
<i>C. filifolia</i> Nutt.	C ₃	Boutton et al. 1980 (A)
<i>C. flava</i> L.	C ₃	LR ($\delta^{13}\text{C}$: -27.4, <i>Lerman s. n.</i> , 1971)
<i>C. fraserianus</i> (Ker Gawl.) Kartesz & Gandhi (<i>Cymophyllus fraseri</i> (Andrews) Mack.)	C ₃	JB (A: <i>s. coll.</i> MEL 154850)
<i>C. grayi</i> J. Carey	C ₃	Hofstra et al. 1972 (A. Γ)
<i>C. haydenii</i> Dewey	C ₃	Standley 1987a ([A])
<i>C. hermannii</i> Cochrane	C ₃	Standley 1987b ([A])
<i>C. indica</i> L.	C ₃	LR ($\delta^{13}\text{C}$: -27.8, <i>Zollinger 313</i>)
<i>C. inversa</i> R. Br.	C ₃	JB (A: <i>Moore 8135</i> CANB)
<i>C. johnstonii</i> Boeck.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. kobomugi</i> Ohwi	C ₃	Akita et al. 1969 ([A]); Takeda et al. 1980 (A. Γ)
<i>C. lacustris</i> Willd.	C ₃	Bender 1971 ($\delta^{13}\text{C}$)
<i>C. lenticularis</i> Michx. var. <i>lenticularis</i>	C ₃	Standley 1987a ([A]); Standley 1990 ([A])
<i>C. liparocarpos</i> Gaudin	C ₃	Kalapos et al. 1997 (A. Γ)
<i>C. maculata</i> Boott	C ₃	KW (A: <i>Wilson 10201</i>)
<i>C. maritima</i> Gunnerus, as <i>C. incurva</i> Lightfoot	C ₃	LR ($\delta^{13}\text{C}$: -26.9, <i>Duclos s. n.</i> , 1938)
<i>C. microglochin</i> Wahlenb.	C ₃	Kukkonen 1970 ([A])
<i>C. monostachya</i> A. Rich.	C ₃	Hesla et al. 1982 (A. $\delta^{13}\text{C}$); Aucour et al. 1994 ($\delta^{13}\text{C}$)
<i>C. neoguineensis</i> C. B. Clarke	C ₃	Hofstra et al. 1972 (A. Γ); JB (A: <i>Smith ANU 15115</i> CANB)
<i>C. nigra</i> (L.) Reichard	C ₃	Standley 1987a ([A])
<i>C. obnupta</i> L. H. Bailey	C ₃	Standley 1990 ([A])
<i>C. pachystylis</i> J. Gay	C ₃	Winter and Troughton 1978 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -33.1, Phytotron Gif cult., 1972)
<i>C. peregrina</i> Link	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>C. petitiana</i> A. Rich., as <i>C. cuprea</i> (Kük.) Nelmes ^a , as <i>C. fischeri</i> K. Schum. ^b , as <i>C. longipedunculata</i> K. Schum. ^c , as <i>C.</i> <i>ninagongensis</i> (Kük.) Robyns ^d	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^{a,b,c,d}
<i>C. pilulifera</i> L.	C ₃	LR ($\delta^{13}\text{C}$: -30.3, <i>Seyrat s. n.</i> , 1912)
<i>C. polyantha</i> F. Muell.	C ₃	JB (A: <i>Bruhl</i> , 17 Nov 1985 CANB)
<i>C. rafflesiana</i> Boott	C ₃	JB (A: <i>Bruhl</i> 551 CANB); Hofstra et al. 1972 (A. Γ)
<i>C. runssoroensis</i> K. Schum.	C ₃	Aucour et al. 1994 ($\delta^{13}\text{C}$); Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. setifolia</i> Kunze ex Kunth	C ₃	LR ($\delta^{13}\text{C}$: -31.9, Phytotron Gif cult., 1972)
<i>C. simensis</i> A. Rich.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. sp.</i>	C ₄ ⁺	Smith and Epstein 1971 ($\delta^{13}\text{C}$)
<i>C. sp.</i>	C ₃	Troughton et al. 1974 ($\delta^{13}\text{C}$)
<i>C. sp.</i>	C ₃	Boutton et al. 1980 (A)
<i>C. spicataniculata</i> C. B. Clarke	C ₃	SCV ($\delta^{13}\text{C}$: -27.72, <i>Schlechter</i> 4759)
<i>C. stenophylla</i> Wahlenb.	C ₃	Williams and Monson 1981 ([A]. Γ)
<i>C. stricta</i> Lam.	C ₃	Bender 1971 ($\delta^{13}\text{C}$); Standley 1987a ([A])
<i>C. strigosa</i> Huds.	C ₃	LR ($\delta^{13}\text{C}$: -30.1, <i>De Vergnes s. n.</i> , 1902)
<i>C. subinflata</i> Nelmes	C ₃	SCV ($\delta^{13}\text{C}$: -25.18, <i>Dod</i> 3467)
<i>C. torta</i> Boott	C ₃	Standley 1987a ([A]); Standley 1990 ([A])
<i>C. vallis-rossetto</i> K. Schum., as <i>C. green-</i> <i>wayi</i> Nelmes	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. verticillata</i> Zoll. & Moritzi	C ₃	Hofstra et al. 1972 (A. Γ)
<i>C. vesicaria</i> L.	C ₃	Shepherd 1976 ([A])
<i>Carpha alpina</i> R. Br.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: <i>Craven</i> 1770 CANB; <i>NGF</i> 10208 CANB); LR ($\delta^{13}\text{C}$: -26.6, <i>Le Guillou s. n.</i> , 1840)
<i>C. nivicola</i> F. Muell.	C ₃	JB (A: <i>Totterdell</i> 373 CANB)
<i>Caustis blakei</i> Kük.	C ₃	Takeda et al. 1985 (A)
<i>C. dioica</i> R. Br.	C ₃	Takeda et al. 1985 (A)
<i>C. flexuosa</i> R. Br.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: <i>Bruhl</i> 130 CANB)
<i>C. pentandra</i> R. Br.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -30.7, <i>Rodway</i> 1558)
<i>C. recurvata</i> Spreng.	C ₃	Takeda et al. 1985 (A)
<i>Cephalocarpus rigidus</i> Gilly	C ₃	JB (A: <i>Maguire</i> 32831U); LR ($\delta^{13}\text{C}$: -27.7, <i>Maguire et al.</i> 30159)
<i>C. australis</i> K. L. Wilson	C ₃	KW (A: <i>Bates</i> 4022; <i>Beaulehole</i> 68256; <i>Williamson</i> NSW 122681)
<i>C. cymbaria</i> R. Br.	C ₃	Takeda et al. 1985 (A); JB (A: <i>Bruhl</i> 101 CANB; <i>Prober</i> 243 CANB); KW (A: <i>Beaulehole</i> 24875; <i>Constable</i> 6204, 4443; <i>Coveny</i> 3832, 5050, 6236, 6693, 9093; <i>Jacobs</i> 3229; <i>Johnson</i> NSW 241350; <i>McBarron</i> 9276; <i>McKee</i> 30542, 43984 NOU; <i>Olsen</i> 2017; <i>Rodway</i> 268; <i>Schmid</i> 3080 NOU; <i>Wilson</i> 3053, 3086, 3094); LR ($\delta^{13}\text{C}$: -27.4, <i>Raynal & Jaf-</i> <i>fré</i> 16459)
<i>C. enodis</i> Nees	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); KW (A: <i>Blake</i> 20736; <i>Coveny</i> 8102; <i>Gunn</i> 1401; <i>Maiden</i> NSW 22493; <i>Melville</i> 1612; <i>Walter</i> NSW 242326; <i>Wil-</i> <i>son</i> 2773)
<i>C. multiarticulata</i> Nees	C ₃	KW (A: <i>Conn</i> 3545; <i>P.G. Wilson</i> 7069 PERTH)
<i>C. sphaerocephala</i> R. Br.	C ₃	KW (A: <i>Beaulehole</i> 32890; <i>Brooks</i> NSW 242163; <i>Camfield</i> NSW 2249, NSW 22496; <i>Coveny</i> 831, 3755, 5025, 6283, 6704; <i>Constable</i> NSW 46244; <i>Maiden</i> NSW 242388; <i>McBarron</i> 8208; <i>Rodway</i> NSW 242331, NSW 242387)
<i>Chorizandra</i> sp. G (<i>Wilson</i> 7192)	C ₃	KW (A)
<i>Chrysitrix capensis</i> L.	C ₃	JB (A: <i>Williams</i> 3240 PRE); LR ($\delta^{13}\text{C}$: -27.9, <i>Humbert</i> 9600)
<i>C. dodii</i> C. B. Clarke	C ₃	JB (A: <i>Esterhuysen</i> 2917 PRE)
<i>C. junciformis</i> C. B. Clarke	C ₃	JB (A: <i>Taylor</i> 3888 PRE); SCV ($\delta^{13}\text{C}$: -23.33, <i>Stokoe s. n.</i>)
<i>Cladium jamaicense</i> Crantz, as <i>C. mariscus</i> (L.) Pohl subsp. <i>jamaicense</i> (Crantz) Kük. ^a , as <i>C. mariscus</i> var. <i>jamaicense</i> (Crantz) ined. ^b	C ₃	Bender 1971 ($\delta^{13}\text{C}$); Hesla et al. 1982 ($\delta^{13}\text{C}$); Aucour et al. 1994 ($\delta^{13}\text{C}$) ^b ; LR ($\delta^{13}\text{C}$: -26.0, <i>Degener</i> 27989) ^a
<i>C. mariscus</i> (L.) Pohl	C ₃	Aucour et al. 1994 ($\delta^{13}\text{C}$)
<i>C. procerum</i> S. T. Blake ^a , as <i>C. mariscus</i> ^b	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$) ^{a,b} ; JB (A: <i>Crisp</i> 6878 CBG)
<i>Coleochloa abyssinica</i> (A. Rich.) Gilly, as <i>Eriospora abyssinica</i> Hochst. ex A. Rich. ^a	C ₃	Chermezon 1930 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -26.1, <i>Dillon &</i> <i>Pettit s. n.</i> , 1842)
<i>C. schweinfurthiana</i> (Boeck.) Nelmes	C ₃	JB (A: <i>s. coll.</i> MEL 1543821)
<i>C. setifera</i> (Ridl.) Gilly, as <i>Eriospora seti-</i> <i>fera</i> (Ridl.) C. B. Clarke ^a	C ₃	Chermezon 1930 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$); SCV ($\delta^{13}\text{C}$: -22.20, <i>Ester-</i> <i>huysen</i> 21464)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>Costularia arundinacea</i> (Solander ex Vahl) Kük. (<i>Lophoschoenus arundinaceus</i> (Solander ex Vahl) Stapf)	C ₃	LR ($\delta^{13}\text{C}$: -27.7, Raynal & Jaffré 16508)
<i>C. chamaedendron</i> (Guill.) Kük.	C ₃	JB (A: McPherson 3055); LR ($\delta^{13}\text{C}$: -29.6, Raynal & Jaffré 16514, -30.4, Serre Orsay cult., 1972)
<i>C. comosa</i> (C. B. Clarke) Kük. (<i>Lophoschoenus comosus</i> (C. B. Clarke) Stapf)	C ₃	JB (A: McKee 7726 BRI)
<i>C. fragilis</i> (Däniker) Kük.	C ₃	JB (A: Hartley 15075 CANB)
<i>C. leucocarpa</i> (Ridl.) H. Pfeiff.	C ₃	JB (A: Bossa 7773 K)
<i>C. pantopoda</i> (Baker) C. B. Clarke	C ₃	LR ($\delta^{13}\text{C}$: -25.1, Humbert 22674)
<i>C. pilisepala</i> (Steud.) Kern, as <i>C. urvilleana</i> (Gaud. ex Boeck.) Kük.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$)
<i>C. pubescens</i> J. Raynal (<i>Lophoschoenus pubescens</i> (J. Raynal) ined.)	C ₃	JB (A: McKee 1051A BRI)
<i>C. stagnalis</i> (Däniker) Kük.	C ₃	JB (A: Hartley 15072 CANB)
<i>Courtoisina assimilis</i> (Steud.) Maquet, as <i>Mariscus assimilis</i> (Steud.) Podlech	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$); Vorster 1996 (A)
<i>C. cyperoides</i> (Roxb.) Soják	C ₃	Druyts-Voets 1970 ([A]); Vorster 1996 (A); JB (A: MEL 1543845, MEL 1543847); LR ($\delta^{13}\text{C}$: -28.2, Fotius 931)
<i>Crosslandia setifolia</i> W. V. Fitzg., as <i>Crosslandia</i> ^a	C ₄	Lerman and Raynal 1972 (A) ^a ; Takeda et al. 1985 (Af. $\delta^{13}\text{C}$); JB (Af: van Rijn 19 CANB; Latz 2774 CANB; Leutert 74 CANB); LR ($\delta^{13}\text{C}$: -11.5, MacKee 8432)
<i>Cyathochaeta avenacea</i> (R. Br.) Benth.	C ₃	Takeda et al. 1985 (A); JB (A: Morrison, 3 Dec 1903 BRI. $\delta^{13}\text{C}$: -26.3, Morrison, 3 Dec 1903); LR ($\delta^{13}\text{C}$: -25.9, Morrison s. n., 1915)
<i>C. diandra</i> (R. Br.) Nees	C ₃	Takeda et al. 1985 (A)
<i>Cyathocoma hexandra</i> (Nees) J. Browning, as <i>Macrochaetium hexandrum</i> (Nees) H. Pfeiff. ^a	C ₃	JB (A: Garside, 10 Oct 1920 K); LR ($\delta^{13}\text{C}$: -29.3, Drège 3944) ^a
<i>Cyperus acuminatus</i> Torr. & Hook.	C ₃	Denton 1983 (A); Li et al. 1999 (A)
<i>C. aggregatus</i> (Willd.) Endl.	C ₄ C ₃ +	KW (Ac: Jacobs NSW 144403) Li et al. 1999 (A)
<i>C. ajax</i> C. B. Clarke	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. albopilosus</i> (C. B. Clarke) Kük., as <i>Mariscus albopilosus</i> C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. albosanguineus</i> Kük., as <i>Mariscus albosanguineus</i> (Kük.) Napper	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. albobstriatus</i> Schrad.	C ₃ C ₄ +	KW (A: Schlechter 2569; Wilson 4383) Sonnenberg and Botha 1992 (A. PIB: NADP)
<i>C. alopecuroides</i> Rottb.	C ₄	Druyts-Voets 1970 ([Ac]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Li and Jones 1994 (A)
<i>C. alterniflorus</i> R. Br.	C ₄	KW (Ac: Martensz 263)
<i>C. alternifolius</i> L.	C ₃	Haberlandt 1884 ([A]); Rikli 1895 ([A]); Brown 1975 (A); Takeda et al. 1980 (A. Γ); Hesla et al. 1982 ($\delta^{13}\text{C}$); Krenzer et al. 1975 (Γ); Li 1993 (A. Γ . $\delta^{13}\text{C}$); Li and Jones 1994 (A); LR ($\delta^{13}\text{C}$: -30.3, Perrier 14816, -35.5, Serre Orsay cult., 1972)
<i>C. amabilis</i> Vahl	C ₄	Druyts-Voets 1970 ([A]); Meinzer 1978 (A); Hesla et al. 1982 ($\delta^{13}\text{C}$); KW (Ac: Adam 2258 P; de la Bâthie 13097); LR ($\delta^{13}\text{C}$: -13.0, Boivin s. n.); SCV ($\delta^{13}\text{C}$: -12.31, Schupers 893)
<i>C. amauropus</i> Steud., as <i>Mariscus amauropus</i> (Steud.) Cufod. ^a	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; KW (Ac: s. coll. 1301, Kenya P); LR ($\delta^{13}\text{C}$: -14.0, Humbert 8502 bis) ^a
<i>C. amuricus</i> Maxim.	C ₄	Ueno and Takeda 1992 (A); KW (Ac: Inamasu 425)
<i>C. anderssonii</i> Boeck.	C ₄	KW (Ac: Schimpff 13 P)
<i>C. andinus</i> Palla	C ₃	LR ($\delta^{13}\text{C}$: -26.5, Mandon 1396)
<i>C. angolensis</i> Boeck.	C ₄	Druyts-Voets 1970 ([A]); KW (Ac: Robinson 2683 P)
<i>C. angustatus</i> R. Br.	C ₄	KW (Ac: Latz 3651)
<i>C. aquatilis</i> R. Br.	C ₃	Carolin et al. 1977 (US); Takeda et al. 1985 (A. $\delta^{13}\text{C}$)
<i>C. articulatus</i> L.	C ₄	Druyts-Voets 1970 ([Ac]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Meinzer 1978 (A)
<i>C. astartodes</i> K. L. Wilson	C ₄	KW (Ac: Specht 649; Wilson 5151)
<i>C. atractocarpus</i> Ridl.	C ₄	Druyts-Voets 1970 ([A])
<i>C. atroviridis</i> C. B. Clarke, as <i>C. aterrimus</i> Steud.	C ₄	Druyts-Voets 1970 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. aucheri</i> Jaub. & Spach	C ₄	KW (Ac: H. Wilson 4, Arabia P)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>C. baoulensis</i> (Chevalier) Kük.	C ₄	KW (Ac: <i>Hall 306</i> P)
<i>C. bellus</i> Kunth [may be referable to <i>C. tanganyicanus</i> (Kük.) K. Lye]	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. bernieri</i> Cherm.	C ₄	KW (Ac: <i>Boivin Voyage 1847–52, 2320</i> P)
<i>C. betchei</i> (Kük.) S. T. Blake subsp. <i>betchei</i>	C ₄	KW (Ac: <i>Payne 4; Wilson 746</i>)
subsp. <i>commiscens</i> K. L. Wilson	C ₄	KW (Ac: <i>Latz 7090</i>)
<i>C. bifax</i> C. B. Clarke, as <i>Cyperus rotundus</i> subsp. <i>retzii</i> ^a	C ₄	Carolin et al. 1977 (USc); Druyts-Voets 1970 ([A]) ^a ; Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$)
<i>C. blakeanus</i> K. L. Wilson	C ₄	KW (Ac: <i>Latz 2200; Wilson 5373</i>)
<i>C. blysmoides</i> C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. bowmanii</i> F. Muell. ex Benth.	C ₄	Carolin et al. 1977 (USc); Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$)
<i>C. bulbosus</i> Vahl	C ₄	Druyts-Voets 1970 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (Ac); KW (Ac: <i>O'Connell NSW 121327</i>); LR ($\delta^{13}\text{C}$: -14.0, <i>Audru 2536</i>)
<i>C. burkartii</i> Guaglianone	C ₃	Guaglianone 1990 ([A])
<i>C. callistus</i> Ridl.	C ₄	Druyts-Voets 1970 ([A]); KW (Ac: <i>Gossweiler 209</i> P)
<i>C. cancrorum</i> Cherm.	C ₄	KW (Ac: <i>Decary 1686</i> P)
<i>C. capensis</i> (Steud.) Endl. var. <i>capensis</i>	C ₄	KW (Ac: <i>Schlechter 3779</i>)
<i>C. capitatus</i> Vandelli	C ₄	Collins and Jones 1985 ($\delta^{13}\text{C}$); Li 1993 (A. $\delta^{13}\text{C}$); JB (Ac: <i>s. coll. MEL 1543828</i>); LR ($\delta^{13}\text{C}$: -11.1, <i>Mabille Hb Cors. 96</i>)
<i>C. carinatus</i> R. Br.	C ₄	KW (Ac: <i>Latz 5176; Wilson 4669</i>)
<i>C. castaneus</i> Willd.	C ₄	Carolin et al. 1977 (USc); Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$)
<i>C. centralis</i> K. L. Wilson	C ₄	KW (Ac: <i>Latz 1911, 2012</i>)
<i>C. cephalotes</i> Vahl (<i>Anosporum cephalotes</i> (Vahl) Kurz)	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$); JB (A: <i>Dharmawardhana 25 CANB; Pullen 7523 CANB</i>); KW (A: <i>Schmid s. n., Indochina</i> P)
<i>C. chalaranthus</i> J. Presl & C. Presl	C ₃	KW (A: <i>Lescure 604</i> P)
<i>C. chordorrhizus</i> Chiovenda	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. chrysocephalus</i> (K. Schum.) Kük.	C ₄	KW (Ac: <i>Baum 311a BRI; de Witte 7185 PRE</i>)
<i>C. circumclusus</i> (C. B. Clarke) Kük., as <i>Mariscus circumclusus</i> C. B. Clarke ^a , as <i>M. macropus</i> C. B. Clarke ^b	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^{a,b} ; KW (Ac: <i>Lewalle s. n., Burundi</i> P); LR ($\delta^{13}\text{C}$: -11.1 <i>Tisserant 1877</i>) ^b
<i>C. clarus</i> S. T. Blake	C ₄	KW (Ac: <i>Blake 5174; Wilson 5749</i>)
<i>C. clavinux</i> C. B. Clarke	C ₄	KW (Ac: <i>Fotius 1603</i>)
<i>C. colymbetes</i> Kotschy & Peyr.	C ₃	Druyts-Voets 1970 ([A])
<i>C. compactus</i> Retz., as <i>Mariscus compactus</i> (Retz.) Boldingh ^a	C ₄	Takeda et al. 1985 (Ac); Ueno and Takeda 1992 (A) ^a
<i>C. compressus</i> L.	C ₄	Druyts-Voets 1970 ([Ac]); Hofstra et al. 1972 (A. Γ); Prakash et al. 1976 (A); Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (Ac); Ueno et al. 1986 (Ac. B); Ueno and Takeda 1992 (A. Γ); Lin et al. 1993 (Ac); KW (Ac: <i>Henty NGF9870</i>); LR ($\delta^{13}\text{C}$: -9.2, <i>Boivin s. n., 1847</i>); SCV ($\delta^{13}\text{C}$: -9.85, <i>de Winter and Giess 6889</i>)
<i>C. concinnus</i> R. Br.	C ₃	KW (A: <i>Wilson 1463</i>)
<i>C. confertus</i> Sw.	C ₄	Rikli 1895 ([A])
<i>C. congensis</i> C. B. Clarke	C ₄	Druyts-Voets 1970 ([A])
<i>C. congestus</i> Vahl, as <i>Mariscus congestus</i> (Vahl) C. B. Clarke ^a	C ₄	Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$); Li 1993 (A. Γ . $\delta^{13}\text{C}$); Li and Jones 1994 (A); Sonnenberg and Botha 1992 (A. PIB: NADP) ^a ; KW (Ac: <i>Wilson 1442</i>); SCV ($\delta^{13}\text{C}$: -9.56, <i>Mogg 11683</i>) ^a
<i>C. conglomeratus</i> Rottb.	C ₄	Sabnis 1921 ([A]); Druyts-Voets 1970 ([A]); Hnatiuk 1980 (A); KW (Ac: <i>de Fabrègues 2759</i> P); LR ($\delta^{13}\text{C}$: -11.6, <i>Jamin s. n., 1852</i>)
<i>C. conicus</i> (R. Br.) Boeck.	C ₄	Carolin et al. 1977 (USc); Takeda et al. 1985 (Ac); KW (Ac: <i>Wilson 1502, 3529</i>)
<i>C. constanzae</i> Urban	C ₃	KW (A: <i>Ekman 6879 K; Harris 12350 K</i>)
<i>C. corneli-ostenii</i> Kük.	C ₄	KW (Ac: <i>Krapovickas 24323</i> P)
<i>C. corymbosus</i> Rottb., as <i>C. corymbosus</i> var. <i>longispiculatus</i> (O. Kuntze) Kük. ^a	C ₄	Mani 1963 ([A]) ^a ; SCV ($\delta^{13}\text{C}$: -10.33, <i>Maputaland Expedition 14319</i>)
<i>C. cracens</i> K. L. Wilson	C ₄	KW (Ac: <i>Benson 2088b; Craven 5826</i>)
<i>C. crassipes</i> Vahl, as <i>C. maritimus</i> Poir. ^a	C ₄	Druyts-Voets 1970 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Adam 1538</i> P); LR ($\delta^{13}\text{C}$: -12.0, <i>Mahoux SF6764</i>) ^a
<i>C. crispulus</i> K. L. Wilson	C ₄	KW (Ac: <i>Blake 17673; Dunlop 5240; Wilson 5303</i>)
<i>C. croceus</i> Vahl (<i>C. globulosus</i> Aublet)	C ₄	KW (Ac: <i>Schallert 28257</i> P)
<i>C. cunninghamii</i> (C. B. Clarke) C. Gardner subsp. <i>cheradicus</i> K. L. Wilson subsp. <i>cunninghamii</i> , as <i>C. cunninghamii</i> ^a	C ₄	Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Coveny 517; Latz 9499; Mitchell 453; Tate NSW 22742; Wilson 5379</i>)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
subsp. <i>uniflorus</i> K. L. Wilson	C ₄	KW (Ac: <i>Wilson 5302</i>)
<i>C. cuspidatus</i> Kunth	C ₄	Druyts-Voets 1970 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (Ac); KW (Ac: <i>de la Bâthie 16099</i>)
<i>C. cyperinus</i> (Retz.) Valck. Sur.	C ₄	Mani 1963 ([A]); Hofstra et al. 1972 (A. Γ)
<i>C. cyperoides</i> (L.) Kuntze, as <i>Mariscus sieberianus</i> Nees ex C. B. Clarke ^a , as <i>M. sumatrensis</i> (Retz.) J. Raynal ^b	C ₄	Hofstra et al. 1972 (A. Γ); Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; Ueno and Takeda 1992 (A. Γ) ^b
<i>C. dactylotes</i> Benth.	C ₄	Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$); KW (Ac: <i>Latz 5126; Martensz 4134</i>)
<i>C. deciduus</i> Boeck.	C ₃ + C ₄	Druyts-Voets 1970 ([A]); Vorster 1990 ([A]); KW (A: <i>Angus 2987 P; Miller 5634; Robinson 4020 P</i>)
<i>C. decompositus</i> (R. Br.) F. Muell.	C ₄	Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$); KW (Ac: <i>Tryon NSW 608854</i>)
<i>C. dentatus</i> Torr.	C ₃	Li et al. 1999 (A. $\delta^{13}\text{C}$); KW (A: <i>Fernald 16273</i>)
<i>C. denudatus</i> L. f. ^a , as <i>C. phaeorrhizus</i> K. Schum. ^b , as <i>C. phaeorrhizus</i> var. <i>filifolia</i> ined. ^c	C ₃	Druyts-Voets 1970 ([A]) ^{a,b,c} ; Hesla et al. 1982 (A. $\delta^{13}\text{C}$) ^{a,b} ; Aucour et al. 1994 ($\delta^{13}\text{C}$) ^a
<i>C. dereilema</i> Steud. ^a , as <i>C. dereilema</i> var. <i>deckenii</i> (Boeck.) ined. ^b	C ₃	Druyts-Voets 1970 ([A]) ^{a,b} ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a
<i>C. dichroostachyus</i> A. Rich.	C ₃	Druyts-Voets 1970 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. dietrichiae</i> Boeck.	C ₄	KW (Ac: <i>Flecker NSW 608855</i>)
<i>C. difformis</i> L.	C ₃	Akita et al. 1969 ([A]); Druyts-Voets 1970 ([A]); Hofstra et al. 1972 (A. Γ); Imai and Murata 1979 (Γ); Takeda et al. 1980 (A. Γ); Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (A); Li 1993 (A. Γ . $\delta^{13}\text{C}$); Li et al. 1999 (A. $\delta^{13}\text{C}$); KW (A: <i>Wilson 1464</i>)
<i>C. digitatus</i> Roxb.	C ₄	Ueno and Takeda 1992 (A); LR ($\delta^{13}\text{C}$: -13.4, <i>Drummond 6576</i>)
subsp. <i>auricomus</i> (Sieb. ex Spreng.) Kük., as <i>C. auricomus</i> Sieb. ex Spreng.	C ₄	Druyts-Voets 1970 ([A]); Li 1993 ($\delta^{13}\text{C}$)
<i>C. disjunctus</i> C. B. Clarke	C ₃	KW (A: <i>Wilson 9907</i>)
<i>C. distans</i> L. f. ^a , as <i>C. distans</i> var. <i>densiflorus</i> Kük. ^b	C ₄	Druyts-Voets 1970 ([A]) ^{a,b} ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; Ueno et al. 1986 (Ac. B) ^a ; Ueno et al. 1988b (USc) ^a ; Ueno and Takeda 1992 (A) ^a ; KW (Ac: <i>Berhaut 3611 P; Flecker NSW 65486; Wilson 3805</i>) ^a
<i>C. distinctus</i> Steud.	C ₃	Denton 1983 (A)
<i>C. diurensis</i> Boeck., as <i>Mariscus diurensis</i> (Boeck.) C. B. Clarke ^a	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Humbert 7234 P</i>)
<i>C. dives</i> Del. ^a , as <i>C. immensus</i> C. B. Clarke ^b	C ₄	Druyts-Voets 1970 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^{a,b} ; KW (Ac: <i>Berhaut 5100 P</i>) ^a ; LR ($\delta^{13}\text{C}$: -13.0, <i>Schlieben 1274</i>) ^b
<i>C. drummondii</i> Torr. & Hook., as <i>C. virens</i> var. <i>drummondii</i> (Torr. & Hook.) Kük.	C ₃	Denton 1983 (A)
<i>C. dubius</i> Rottb., as <i>Mariscus dubius</i> (Rottb.) Kük. ex Fisch. ^a	C ₄	Hnatiuk 1980 (A); Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Vorster 2566</i>); LR ($\delta^{13}\text{C}$: -12.7, <i>Chevalier 21665 P</i>) ^a
<i>C. duripes</i> I. M. Johnst.	C ₄	KW (Ac: <i>Anthony 400 US</i>)
<i>C. durus</i> Kunth, as <i>Mariscus durus</i> (Kunth) C. B. Clarke	C ₄	Vorster 1990 (A)
<i>C. echinatus</i> (L.) Alph. Wood, as <i>C. ovalaris</i> (Michx.) Torr.	C ₄	Li 1993 ($\delta^{13}\text{C}$)
<i>C. ekmanii</i> Kük.	C ₄	KW (Ac: <i>Ekman 14980 US</i>)
<i>C. elatus</i> L.	C ₄	Mani 1960 ([A])
<i>C. elegans</i> L.	C ₄	Druyts-Voets 1970 ([A]); KW (Ac: <i>Pringle 5946; Gentle 801</i>); LR ($\delta^{13}\text{C}$: -11.3, <i>Rodriguez 3200</i>)
<i>C. entrerianus</i> Boeck.	C ₃	LR ($\delta^{13}\text{C}$: -26.6, <i>Hassler 7866</i>)
<i>C. eragrostis</i> Vahl, as <i>C. vegetus</i> Willd. ^a	C ₃	Druyts-Voets 1970 ([A]); Denton 1983 (A); Bruhl et al. 1987 (A. B); Li 1993 (A. Γ . $\delta^{13}\text{C}$); Li and Jones 1994 (A) ^a ; Soros and Dengler 2001 (A); JB (A: <i>Bruhl 658 CANB; Ferreira 63 BRI; Tryon BRI 186483</i> . Γ : 42, 46, <i>Bruhl 658</i> . $\delta^{13}\text{C}$: -26.6, <i>Tryon BRI 186483</i>); KW (A: <i>Wilson 633</i>); LR ($\delta^{13}\text{C}$: -26.8, <i>Duffort SEFFH 1649</i> , -27.6, <i>Brown 119</i>)
<i>C. erythrorhizos</i> Muhl.	C ₄ + C ₄	Downton and Tregunna 1968 (Γ); Troughton et al. 1974 ($\delta^{13}\text{C}$)
<i>C. esculentus</i> L.	C ₄	Li et al. 1999 (A)
	C ₄	Moss et al. 1969 (Γ); Chen et al. 1970 (Γ); Druyts-Voets 1970 ([A]); Syvertsen et al. 1976 (A); Krenzer et al. 1975 (Γ); Hesla et al. 1982 ($\delta^{13}\text{C}$); Li 1993 (Γ . $\delta^{13}\text{C}$); Li et al. 1999 (A. $\delta^{13}\text{C}$); JB (Ac: <i>Everist 6052 BRI</i>); KW (Ac: <i>Johnson 7692</i>); LR ($\delta^{13}\text{C}$: -12.1, <i>Sellier Sté Roch. 4501 P</i>)
<i>C. exaltatus</i> Retz.	C ₄	Mani 1963 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (Ac); JB (Ac: <i>s. coll.</i> CANB 112270); KW (Ac: <i>Solling 496</i>)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
subsp. <i>iwasakii</i> (Makino) T. Koyama	C ₄	Ueno and Takeda 1992 (A)
<i>C. exilis</i> Willd. ex Kunth	C ₄	KW (Ac: <i>Bosser 15824</i> P)
<i>C. fastigiatus</i> Rottb.	C ₄	Sonnenberg and Botha 1992 (A. PIB: NAD/PCK); KW (Ac: <i>Burchell 1773</i>)
<i>C. fertilis</i> Boeck.	C ₃	Druyts-Voets 1970 ([A]); LR ($\delta^{13}\text{C}$: -33.7, Serre Orsay cult., 1972 P, -36.6, <i>de Witte 7660</i>)
<i>C. filiculmis</i> Vahl	C ₄	Bender 1971 ($\delta^{13}\text{C}$); Li et al. 1999 (A. $\delta^{13}\text{C}$)
<i>C. fischerianus</i> A. Rich.	C ₃	Druyts-Voets 1970 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. fissus</i> Steud.	C ₄	Druyts-Voets 1970 ([A])
<i>C. flaccidus</i> R. Br.	C ₃	Ueno and Takeda 1992 (A. Γ); KW (A: <i>Coveny 4861</i>)
<i>C. flexuosus</i> Vahl (<i>Torulinium flexuosum</i> (Vahl) T. Koyama)	C ₄	KW (Ac: <i>Wilson 2399</i>)
<i>C. foliaceus</i> C. B. Clarke	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. frerei</i> C. B. Clarke	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. fucosus</i> K. L. Wilson, as <i>C. angustatus</i> [voucher re-determined at NSW by KLW]	C ₄	Takeda et al. 1985 (A. $\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Wilson 5501</i>)
<i>C. fulgens</i> C. B. Clarke, as <i>C. fulgens</i> var. <i>fulgens</i> ^a	C ₄	Druyts-Voets 1970 ([A]); SCV ($\delta^{13}\text{C}$: -11.41, <i>Rev. Lawson s. n.</i>) ^a
<i>C. fuliginus</i> Chapm.	C ₄	KW (Ac: <i>Shafer 2488</i> P)
<i>C. fulvus</i> R. Br.	C ₄	Carolin et al. 1977 (USc); KW (Ac: <i>Coveny 3916</i> ; <i>Wilson 5820, 5826</i>)
<i>C. fuscus</i> L.	C ₃	Li 1993 (A. $\delta^{13}\text{C}$) Kalapos et al. 1997 (A. Γ . $\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -28.1, <i>Bec in Arènes 3742</i>)
<i>C. gardneri</i> Nees var. <i>gardneri</i>	C ₃	KW (A: <i>van Hermann 107</i> P)
var. <i>vegetior</i> Kük.	C ₃	KW (A: <i>Wilson 1344</i> P)
<i>C. giganteus</i> Vahl	C ₄	Rodrigues and Estelita 2003 (A); LR ($\delta^{13}\text{C}$: -12.1, <i>Glaziou s. n.</i> , 1880)
<i>C. gilesii</i> Benth., as <i>C. aff. gilesii</i> ^a	C ₄	Carolin et al. 1977 (USc) ^a ; Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$); KW (Ac: <i>Mills & Cox 23</i> ; <i>Milthorpe & Cunningham 1725</i>)
<i>C. glaber</i> L., as <i>Chlorocyperus glaber</i> (L.) Palla ^a	C ₄	Collins and Jones 1985 ($\delta^{13}\text{C}$); Li 1993 (A. $\delta^{13}\text{C}$); Kalapos et al. 1997 (A. $\delta^{13}\text{C}$) ^a
<i>C. glaucophyllus</i> Boeck.	C ₃ + C ₃	Li 1993 (A. $\delta^{13}\text{C}$) Druyts-Voets 1970 ([A])
<i>C. glomeratus</i> L., as <i>Chlorocyperus glomeratus</i> (L.) Palla ^a	C ₄	Collins and Jones 1985 ($\delta^{13}\text{C}$); Ueno and Takeda 1992 (A); Li 1993 (A); Kalapos et al. 1997 (A. $\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Licent 1671</i> P)
<i>C. gracilis</i> R. Br.	C ₃ + C ₃	Li 1993 (A) JB (A: <i>Bruhl 519</i> CANB. Γ : 40, <i>Bruhl 519</i>); LR ($\delta^{13}\text{C}$: -29.2, <i>Schmid 3472</i> , -31.2, Serre Orsay cult., 1972)
<i>C. grandibulbosus</i> C. B. Clarke (<i>C. giolii</i> Chiovenda)	C ₄	KW (Ac: <i>Mwangangi 600</i> P)
<i>C. grandis</i> C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. grayi</i> Torr.	C ₄	Li et al. 1999 (A. $\delta^{13}\text{C}$); KW (Ac: <i>Dowell 6014</i>)
<i>C. grayoides</i> Mohl., as <i>C. "grayioides"</i> [sic]	C ₄	Li et al. 1999 (A. $\delta^{13}\text{C}$)
<i>C. gunnii</i> Hook. f. subsp. <i>gunnii</i> , as <i>Mariscus gunnii</i> (Hook. f.) C. B. Clarke ^a	C ₄	Bruhl et al. 1987 (Ac. B) ^a ; JB (Ac: <i>Bruhl 29</i> CANB); KW (Ac: <i>Salasoo 2996</i> ; <i>Wilson 4422, 4439</i>)
subsp. <i>novaehollandiae</i> (Boeck.) K. L. Wilson	C ₄	KW (Ac: <i>Wilson 3789</i>)
<i>C. gymnocaulos</i> Steud.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: <i>Martensz 3249</i> CANB)
<i>C. hamulosus</i> M. Bieb. ("Monandrus hamulosus" (M. Bieb.) ined.)	C ₄	Li 1993 (A. $\delta^{13}\text{C}$); JB (Ac: <i>Paun MEL 11543826</i> ; <i>Smith 1138</i> PRE); KW (Ac: <i>Ramsay 8</i> MEL)
<i>C. haspan</i> L.	C ₃	Druyts-Voets 1970 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Ueno et al. 1986 (A. B); Ueno and Takeda 1992 (A. Γ)
<i>C. hemisphaericus</i> Boeck., as <i>Mariscus hemisphaericus</i> (Boeck.) C. B. Clarke ^a	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Pawek 6514</i> P; <i>Wilson 2014</i>)
<i>C. hensii</i> C. B. Clarke	C ₄	Druyts-Voets 1970 ([A]); KW (Ac: <i>Chevalier 11242</i> P)
<i>C. hermaphroditus</i> (Jacq.) Standley, as <i>C. incompletus</i> (Jacq.) Link	C ₄	Rikli 1895 ([Ac])
<i>C. hesperius</i> K. L. Wilson	C ₄	KW (Ac: <i>Beaglehole 11352, 48650</i>)
<i>C. hieronymi</i> Boeck.	C ₃	KW (A: <i>Venturi 6841</i> US)
<i>C. hillebrandii</i> Boeck.	C ₄	KW (Ac: <i>Hillebrand</i> NSW 608853)
<i>C. holoschoenus</i> R. Br.	C ₄	Carolin et al. 1977 (USc); Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$); KW (Ac: <i>Blake 12556, 16301</i>)
<i>C. holostigma</i> C. B. Clarke ex Schweinf.	C ₄	KW (Ac: <i>Kelly 129</i> P)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>C. holstii</i> Kük.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -10.5, <i>Sacleux 2310</i>)
<i>C. houghtonii</i> Torr.	C ₄	Li et al. 1999 (A. $\delta^{13}\text{C}$); KW (Ac: <i>Umbach 2470</i>)
<i>C. humilis</i> Kunth	C ₃	KW (A: <i>von Turkheim</i> NSW 608978); LR ($\delta^{13}\text{C}$: -28.0)
<i>C. hystricinus</i> Fernald	C ₄	Li et al. 1999 (A)
<i>C. imbricatus</i> Retz.	C ₄	Mani 1963 ([A]); Druyts-Voets 1970 ([A]); Ueno and Takeda 1992 (A); LR ($\delta^{13}\text{C}$: -13.1, <i>Le Testu 2847</i>)
<i>C. impubes</i> Steud., as <i>Mariscus impubes</i> (Steud.) Napper	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
var. <i>fallax</i> (Cherm.) Kük. (<i>C. fallax</i> Cherm.)	C ₄	KW (Ac: <i>de la Bâthie 13098</i> P)
<i>C. incompressus</i> C. B. Clarke	C ₄	KW (Ac: <i>Jacques-Félix 7216</i> P); LR ($\delta^{13}\text{C}$: -11.0, <i>Jacques-Félix 7216</i>)
<i>C. incomtus</i> Kunth	C ₃	KW (A: <i>Venturi 5633</i>)
<i>C. indecorus</i> Kunth	C ₄	KW (Ac: <i>O'Connor 16</i>)
<i>C. indecorus</i> var. <i>decurvatus</i> (C. B. Clarke) Kük.	C ₄	KW (Ac: <i>Vorster 2504</i>)
<i>C. intricatus</i> Schrad. ex Schultes	C ₃	Denton 1983 (A)
<i>C. involucratus</i> Rottb., as <i>C. alternifolius</i> L. subsp. <i>flabelliformis</i> (Rottb.) Kük. ^a , as <i>C. flabelliformis</i> Rottb. ^b	C ₃	Druyts-Voets 1970 ([A]) ^b ; Hofstra et al. 1972 (A. Γ) ^b ; Ehleringer et al. 1987 ($\delta^{13}\text{C}$) ^a ; Li and Jones 1994 (A); KW (A: <i>Wilson 4384</i>)
<i>C. iria</i> L.	C ₄	Akita et al. 1969 ([A]); Druyts-Voets 1970 ([A]); Hofstra et al. 1972 (A. Γ); Carolin et al. 1977 (USc); Takeda et al. 1980 (Ac. Γ); Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (Ac); Ueno et al. 1986 (Ac. B); Ueno et al. 1988b (USc); Lin et al. 1993 (Ac); Ueno 1998a (US); Ueno 2004 (B [kinetics]); JB (Ac: <i>Bruhl 207</i> CANB; <i>Latz 1527</i> CANB); KW (Ac: <i>Coveny 3499</i> ; <i>Streimann & Kairo NGF 27568</i>); LR ($\delta^{13}\text{C}$: -11.9, <i>Chevalier 24693</i>)
var. <i>flavescens</i> Benth.	C ₄	Druyts-Voets 1970 ([A])
<i>C. isabellinus</i> K. L. Wilson	C ₄	KW (Ac: <i>Wilson 3348</i>)
<i>C. ixiocarpus</i> F. Muell.	C ₄	KW (Ac: <i>Chippendale 2078</i> ; <i>Latz 1255</i> , <i>6698</i>)
<i>C. javanicus</i> Houtt., as <i>M. javanicus</i> (Houtt.) Merr. & Metc. ^a	C ₄	Hofstra et al. 1972 (A. Γ); Ueno and Takeda 1992 (A) ^a
<i>C. jeminicus</i> Rottb.	C ₄	LR ($\delta^{13}\text{C}$: -12.7, <i>Chevalier 1235</i>)
<i>C. kaessneri</i> C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. kappleri</i> Hochst. ex Steud.	C ₄	KW (Ac: <i>Holt 260</i> NY)
<i>C. karlschumanii</i> C. B. Clarke	C ₄	KW (Ac: <i>Aké Assi 6513</i> P)
<i>C. kerstenii</i> Boeck., as <i>Mariscus kerstenii</i> (Boeck.) C. B. Clarke	C ₄	Hesla et al. 1982 (A. $\delta^{13}\text{C}$)
<i>C. kilimandscharicus</i> Kük.	C ₄	Hesla et al. 1982 (A. $\delta^{13}\text{C}$)
<i>C. kipasensis</i> Cherm., as <i>C. platycaulis</i> var. <i>kipasensis</i> (Cherm.) A. Peter & Kük. ^a	C ₃	Druyts-Voets 1970 ([A]) ^a ; KW (A: <i>de Witte 3339</i> NSW ex P)
<i>C. kirkii</i> C. B. Clarke	C ₄	KW (Ac: <i>Biegel 2065</i> P)
<i>C. koyaliensis</i> Cherm.	C ₄	LR ($\delta^{13}\text{C}$: -12.6, <i>Chevalier 20553</i> P)
<i>C. lacunosus</i> Griseb.	C ₄	KW (Ac: <i>Leon 8199</i> P)
<i>C. laeteflorens</i> (C. B. Clarke) Kük.	C ₄	KW (Ac: <i>McKee 7956</i>)
<i>C. laevigatus</i> L., as <i>Juncellus laevigata</i> [sic] (L.) C. B. Clarke ^a	C ₄	Borchers et al. 1982 (A); Druyts-Voets 1970 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Frey and Kürschner 1983 (A. $\delta^{13}\text{C}$); Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$); Li 1993 (A. $\delta^{13}\text{C}$); Bruhl et al. 1987 (Ac. B) ^a ; JB (Ac: <i>Bruhl 65</i> CANB; <i>Paijmans 2762</i> CANB; <i>Symon 13169</i> CANB); KW (Ac: <i>Barry 65</i>); LR ($\delta^{13}\text{C}$: -12.1, <i>Balansa 736</i> P); SCV ($\delta^{13}\text{C}$: -9.31, <i>Bolus 715</i>)
<i>C. laevis</i> R. Br.	C ₃	KW (A: <i>Rodd 2262</i>)
<i>C. lancastrimensis</i> Porter	C ₄	Li et al. 1999 (A. $\delta^{13}\text{C}$)
<i>C. latifolius</i> Poir.	C ₄	Druyts-Voets 1970 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Aucour et al. 1994 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -13.0, <i>Humbert 7778</i>)
<i>C. latzii</i> K. L. Wilson	C ₄	KW (Ac: <i>Latz 5270</i>)
<i>C. laxus</i> Lam., as <i>C. diffusus</i> Vahl ^a	C ₃	Prakash et al. 1976 (A); LR ($\delta^{13}\text{C}$: -32.7, <i>Serre Orsay</i> cult., -36.5, <i>Gilles 180</i>)
subsp. <i>buchholzii</i> (Boeck.) K. Lye, as <i>C. diffusus</i> subsp. <i>buchholzii</i> (Boeck.) Kük.	C ₃	Druyts-Voets 1970 ([A])
subsp. <i>sylvestris</i> (Ridl.) K. Lye, as <i>Cyperus diffusus</i> subsp. <i>sylvestris</i> (Ridl.) Kük.	C ₃	Druyts-Voets 1970 ([A])

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>C. lecontei</i> Torr. ex Steud.	C ₃	KW (A: <i>Curtiss 5714</i>)
<i>C. leiocaulon</i> Benth.	C ₄	Carolin et al. 1977 (USc); KW (Ac: <i>Payne 16</i>)
<i>C. leptocladus</i> Kunth	C ₃	SCV ($\delta^{13}\text{C}$: -27.37 , <i>Maputaland Expedition 14316</i>)
<i>C. leucocephalus</i> Retz.	C ₃	Simpson 1990 (A); KW (A: <i>Nat. Collector no. D1210</i> , Thailand P)
<i>C. lhotskyanus</i> Boeck. (<i>Mariscus rutilans</i> C. B. Clarke, as <i>C. rutilans</i> (C. B. Clarke) Maiden & Betche ^a)	C ₄	Hattersley et al. 1977 (Ac. B [IL]) ^a ; Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$) ^a ; JB (Ac: <i>Hattersley</i> , 10 Dec 1979 voucher at RSBS); KW (Ac: <i>Beauglehole 49697</i> ; <i>Rupp NSW 65130</i> ; <i>Wilson 4441, 4442, 5877, 5878</i>)
<i>C. ligularis</i> L., as <i>Mariscus ligularis</i> (L.) Urb. ^a	C ₄	Hnatiuk 1980 (A); LR ($\delta^{13}\text{C}$: -11.1 , <i>Leprieur s. n.</i> , 1824) ^a
<i>C. limosus</i> Maxim.	C ₃	LR ($\delta^{13}\text{C}$: -26.0 , <i>Maximowicz s. n.</i> , 1859, R. Amur)
<i>C. longibracteatus</i> Cherm., as <i>Mariscus longibracteatus</i> Cherm. ^a	C ₄	Druyts-Voets 1970 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Bosser 7220 P</i>); LR ($\delta^{13}\text{C}$: -10.8 , <i>Le Testu 8875</i>) ^a
var. <i>niger</i> (C. B. Clarke) K. Lye, as <i>Mariscus keniensis</i> (Kük.) S. S. Hooper	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); Vorster 1990 (A); SCV ($\delta^{13}\text{C}$: -9.99 , <i>Burt-Davy s. n.</i>)
var. <i>rubrotinctus</i> (Cherm.) Kük., as <i>Mariscus rubrotinctus</i> Cherm.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. longus</i> L., as <i>C. longus</i> var. <i>longus</i> ^a	C ₄	Haberlandt 1882 ([Ac]); Lerman and Raynal 1972 (A); Jones et al. 1981 (Ac. B. T. USc); Hesla et al. 1982 ($\delta^{13}\text{C}$); Li 1993 (A. T. $\delta^{13}\text{C}$); Li and Jones 1994 (A); LR ($\delta^{13}\text{C}$: -9.1 , <i>Lejeune 713</i>); SCV ($\delta^{13}\text{C}$: -8.16 , <i>Schlechter 3925</i>) ^a
subsp. <i>tenuiflorus</i> (Rottb.) Kük., as <i>C. longus</i> var. <i>tenuiflorus</i> (Rottb.) Boeck. ^a	C ₄	Druyts-Voets 1970 ([A]); SCV ($\delta^{13}\text{C}$: -10.90 , <i>Bolus 3926</i>) ^a
var. <i>pallidus</i> Boeck.	C ₄	Druyts-Voets 1970 ([Ac]); Borchers et al. 1982 (A)
<i>C. lucidus</i> R. Br. (<i>Mariscus lucidus</i> (R. Br.) C. B. Clarke)	C ₄	JB (Ac: <i>Bruhl 75 CANB</i>); KW (Ac: <i>Constable 6217</i> ; <i>Corrick 7936</i>)
<i>C. lupulinus</i> (Spreng.) Marcks	C ₄	Li et al. 1999 (A. $\delta^{13}\text{C}$); KW (Ac: <i>Tolstead 41551 MO</i>)
subsp. <i>macilentus</i> (Fernald) Marcks	C ₄	KW (Ac: <i>Kneucker 91</i>)
<i>C. luteus</i> Boeck., as <i>Mariscus luteus</i> (Boeck.) C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. luzulae</i> (L.) Retz.	C ₃	Druyts-Voets 1970 ([A]); Denton 1983 (A); KW (Ac: <i>Wilson 1586</i>); LR ($\delta^{13}\text{C}$: -30.0 , <i>Rodriguez 4853</i>)
<i>C. macrocarpus</i> (Kunth) Boeck., as <i>Mariscus macrocarpus</i> C. B. Clarke ^a	C ₄	Hesla et al. 1982 (A. $\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Troupin 7178 P</i> ; <i>Vorster 2637</i>)
var. <i>humbertii</i> (Cherm.) Kük.	C ₄	KW (Ac: <i>Bosser 18951 P</i>)
var. <i>pseudoflavus</i> (Kük.) K. Lye, as <i>Mariscus macer</i> Kunth	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. macrocephalus</i> Liebm. (<i>Torulinium macrocephalum</i> (Liebm.) C. B. Clarke, <i>C. eggersii</i> Boeck.)	C ₄	KW (Ac: <i>Croat 23370 P</i> ; <i>Leon 9120 P</i>)
<i>C. maculatus</i> Boeck.	C ₄	Druyts-Voets 1970 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. malaccensis</i> Lam.	C ₄	Mani 1963 ([A]; Hofstra et al. 1972 (A. T. $\delta^{13}\text{C}$); KW (Ac: <i>Floyd NGF 8041</i>)
<i>C. manimae</i> Kunth var. <i>asperrimus</i> (Liebm.) Kük.	C ₄	KW (Ac: <i>Pringle 13237</i>)
var. <i>manimae</i> (<i>C. phaeocephalus</i> Griseb.)	C ₄	KW (Ac: <i>Benoist 2646 P</i>)
<i>C. mannii</i> C. B. Clarke	C ₃	LR ($\delta^{13}\text{C}$: -33.0 , <i>Letouzey 7957</i>)
<i>C. mapanioides</i> C. B. Clarke	C ₃	Druyts-Voets 1970 ([A]); LR ($\delta^{13}\text{C}$: -31.9 , <i>Le Testu 2763</i>)
var. <i>major</i> Boeck.	C ₃	Druyts-Voets 1970 ([A])
<i>C. maranguensis</i> K. Schum.	C ₄	Hesla et al. 1982 (A. $\delta^{13}\text{C}$)
<i>C. margaritaceus</i> Vahl ^a , as <i>C. margaritaceus</i> var. <i>prorrepens</i> Kük. ^b , as <i>C. margaritaceus</i> var. <i>pseudoniveus</i> (Boeck.) C. B. Clarke ^c	C ₄	Druyts-Voets 1970 ([A]) ^{a,b,c} ; KW (Ac: <i>Schlechter 11591</i>); LR ($\delta^{13}\text{C}$: -10.6 , <i>Sacleux 873</i>) ^a
<i>C. marginatus</i> Thunb.	C ₃	SCV ($\delta^{13}\text{C}$: -26.27 , <i>Ward 12292</i>)
<i>C. medusaeus</i> Chiovenda	C ₄	Kukkonen and Lye 1996 (A)
<i>C. meeboldii</i> Kük.	C ₄	LR ($\delta^{13}\text{C}$: -12.5 , <i>Audru 2215</i>)
<i>C. megalanthus</i> (Kük.) G. C. Tucker, as <i>C. pseudovegetus</i> var. <i>megalanthus</i> Kük.	C ₃	Denton 1983 (A)
<i>C. meyenianus</i> Kunth	C ₄	KW (Ac: <i>Montes 1507</i> ; <i>Orth 708</i> ; <i>Riedel 904 US</i>)
<i>C. michelianus</i> (L.) Delile, as <i>Dichostylis micheliana</i> (L.) Nees ^a , as <i>C. michelianus</i> subsp. <i>michelianus</i> ^b	C ₄	Druyts-Voets 1970 ([A]); Li 1993 (A. $\delta^{13}\text{C}$); Kalapos et al. 1997 (A. $\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Kneucker 33a</i>); LR ($\delta^{13}\text{C}$: -12.3 , <i>Duclos s. n.</i> , 1933) ^b
<i>C. michoacanensis</i> Britton	C ₃	Simpson 1990 (A); KW (A: <i>Pringle 4269 P</i> ; <i>Purpus 267 p.p.</i> US)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>C. microcephalus</i> R. Br. [identity unclear: voucher number is for a dicot]	C ₄	Takeda et al. 1985 (A)
subsp. <i>chersophilus</i> K. L. Wilson	C ₄	KW (Ac: <i>Fitzgerald</i> NSW 153243; <i>Wilson</i> 4891)
subsp. <i>microcephalus</i>	C ₄	KW (Ac: <i>Black</i> 14; <i>Latz</i> 7377; <i>Wilson</i> 4874, 5202, 5556)
subsp. <i>saxicola</i> K. L. Wilson	C ₄	KW (Ac: <i>Jacobs</i> 1535; <i>Latz</i> 3102; <i>Wilson</i> 5191, 5223)
<i>C. microglumis</i> D. A. Simpson	C ₃	Simpson 1990 (A)
<i>C. microiria</i> Steud.	C ₄	Imai and Murata 1979 (Γ); Ueno et al. 1986 (Ac. B); Ueno and Takeda 1992 (A. Γ); Li et al. 1999 (A); KW (Ac: <i>Ohwi</i> NSM 308; <i>Hashimoto</i> TNS 1269)
<i>C. miliifolius</i> Poepp. & Kunth ex Kunth	C ₃	KW (A: <i>Croat</i> 19806 P)
<i>C. mitis</i> Steud.	C ₄	Mani 1963 ([A])
<i>C. mollipes</i> (C. B. Clarke) K. Schum. (<i>Ascopholis gamblei</i> C. E. C. Fisch.), as <i>Mariscus mollipes</i> C. B. Clarke ^a	C ₄	Hesla et al. 1982 (δ ¹³ C) ^a ; JB (Ac: <i>Nijalingappa</i> NSW 709497); KW (Ac: <i>Le-walle</i> 2052 P)
<i>C. mutisii</i> (Kunth) Griseb.	C ₄	KW (Ac: <i>Barkley</i> 14092 NY; <i>Pringle</i> 4476)
<i>C. nanus</i> Willd.	C ₄	KW (Ac: <i>Harris</i> 12359 P)
<i>C. natalensis</i> Hochst.	C ₄	SCV (δ ¹³ C: -9.95, <i>Hood</i> 860)
<i>C. nayaritensis</i> Tucker	C ₃	Simpson 1990 (A)
<i>C. nduru</i> Cherm., as <i>C. margaritaceus</i> var. <i>nduru</i> (Cherm.) Kük.	C ₄	Druyts-Voets 1970 ([A])
<i>C. nipponicus</i> Franch. & Sav.	C ₄	Ueno et al. 1986 (Ac. B); Ueno et al. 1988b (USc); Ueno and Takeda 1992 (A. Γ)
<i>C. niveus</i> Retz.	C ₄	Sabnis 1921 ([A]); Hnatiuk 1980 (A)
var. <i>flavissimus</i> (Schrad.) K. Lye, as <i>C. obtusiflorus</i> var. <i>flavissimus</i> (Schrad.) Boeck.	C ₄	Druyts-Voets 1970 ([A])
var. <i>leucocephalus</i> (Kunth) Fosberg, as <i>C. obtusiflorus</i> Vahl ^a , as <i>C. obtusiflorus</i> var. <i>tenerior</i> C. B. Clarke ^b , as <i>C. obtusiflorus</i> var. <i>macrostachys</i> ined. ^c	C ₄	Druyts-Voets 1970 ([A]) ^{a,b,c} ; Hesla et al. 1982 (δ ¹³ C); KW (Ac: <i>Decary</i> 12835); LR (δ ¹³ C: -12.4, <i>Bachmann</i> 78)
var. <i>tisserantii</i> (Cherm.) K. Lye	C ₄	KW (Ac: <i>Boudet</i> 2420 P)
<i>C. nutans</i> Vahl	C ₄	Ueno et al. 1986 (Ac. B); Ueno and Takeda 1992 (A)
subsp. <i>eleusinoides</i> (Kunth) Haines	C ₄	KW (Ac: <i>Blake</i> 7718)
<i>C. oblongo-incrassatus</i> Kük., as <i>Mariscus taylori</i> C. B. Clarke	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>C. obsoletinervosus</i> A. Peter & Kük., as <i>Mariscus obsoletinervosus</i> (A. Peter & Kük.) Greenway ^a	C ₄	Hesla et al. 1982 (δ ¹³ C) ^a ; KW (Ac: <i>Polhill & Paulo</i> 964 P)
<i>C. ochraceus</i> Vahl	C ₃	Denton 1983 (A)
<i>C. odoratus</i> L., as <i>Torulinium odoratum</i> (L.) S. S. Hooper ^a , as <i>T. ferax</i> (Rich.) Ham. ^b	C ₄	Bender 1971 (δ ¹³ C); Ueno et al. 1988b (USc) ^b ; Ueno and Takeda 1992 (A) ^a ; Ueno et al. 1986 (Ac. B) ^b ; Li et al. 1999 (A. δ ¹³ C); JB (Ac: <i>Darbyshire</i> 708); KW (Ac: <i>Heller</i> 2466 P); LR (δ ¹³ C: -10.5, <i>Mocquerys s. n.</i> , <i>Venezuela</i>) ^a
<i>C. ohwii</i> Kük.	C ₄	Ueno et al. 1986 (Ac. B); Ueno and Takeda 1992 (A. Γ)
<i>C. orgadophilus</i> K. L. Wilson	C ₄	KW (Ac: <i>Latz</i> 7144)
<i>C. orthostachys</i> Franch. & Sav., as <i>C. truncatus</i> C. A. Mey. ex Turcz. ^a	C ₄	Lerman and Raynal 1972 (A) ^a ; Ueno et al. 1986 (Ac. B); Ueno and Takeda 1992 (A. Γ); KW (Ac: <i>Fox</i> NSW 618282); LR (δ ¹³ C: -15.0, <i>Karo</i> 90) ^a
<i>C. oxycarpus</i> S. T. Blake	C ₄	KW (Ac: <i>Blake</i> 9209; <i>Latz</i> 7298)
<i>C. oxylepis</i> Nees ex Steud.	C ₄	KW (Ac: <i>Pedersen</i> 9611)
<i>C. palianparaiensis</i> Govindarajalu	C ₃	Govindarajalu 1990b ([A])
<i>C. panamensis</i> (C. B. Clarke) Britton	C ₄	KW (Ac: <i>Standley</i> 29144 US)
<i>C. pangorei</i> Rottb.	C ₄	KW (Ac: <i>Wight</i> NSW 608850)
<i>C. pannonicus</i> Jacq., as <i>Acorellus pannonicus</i> (Jacq.) Palla ^a	C ₄	Li 1993 (A. δ ¹³ C); Kalapos et al. 1997 (A. δ ¹³ C) ^a ; JB (Ac: <i>s. coll.</i> MEL 1543854)
<i>C. papyrus</i> L. ^a , as <i>C. papyrus</i> subsp. <i>ugandensis</i> Chiov. ^b	C ₄	Haberlandt 1884 ([Ac]) ^a ; Rikli 1895 ([A]) ^a ; Druyts-Voets 1970 ([A]) ^{a,b} ; Krenzer et al. 1975 (Γ) ^a ; Jones and Milburn 1978 (A. Γ) ^a ; Hesla et al. 1982 (A. δ ¹³ C) ^a ; Li 1993 (A. Γ. δ ¹³ C) ^a ; Aucour et al. 1994 (δ ¹³ C) ^a ; Li and Jones 1994 (A) ^a ; JB (Ac: <i>Lau</i> 2112 NE; <i>Lepschi</i> 1505 NE) ^a ; LR (δ ¹³ C: -11.0, -11.9, <i>Dang</i> 178, -12.0, -12.8, <i>Killick</i> 3419) ^a
as <i>Papyrus</i> [sic] ^b , as <i>Papyrus cicuta</i> ^a	C ₃ +	Moss et al. 1969 (Γ) ^a ; Tregunna et al. 1970 (A. B. Γ. δ ¹³ C) ^b ; Hofstra et al. 1972 (A. Γ)
<i>C. pectinatus</i> Vahl, as <i>C. nudicaulis</i> Poir. ^a	C ₃	Druyts-Voets 1970 ([A]) ^a ; Ellery et al. 1992 (δ ¹³ C); LR (δ ¹³ C: -27.8, <i>Le-prieur s. n.</i> , <i>Senegal</i>) ^a

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>C. pedunculatus</i> (R. Br.) Kern, as <i>Remirea</i> ^a , as <i>Remirea maritima</i> Aubl. ^b , as <i>Mariscus pedunculatus</i> (R. Br.) Koyama ^c	C ₄	Hofstra et al. 1972 (A. Γ); Lerman and Raynal 1972 (A) ^a ; Ueno and Takeda 1992 (A) ^c ; JB (Ac: <i>Blake 8261</i> BRI; <i>Bruhl 496</i> CANB; <i>Lazarides 563</i> CANB; <i>Pullen 1181</i> CANB); LR (δ ¹³ C: -13.5, <i>Chevalier 23474</i>) ^b
<i>C. perangustus</i> S. T. Blake	C ₄	KW (Ac: <i>Blake 11304</i>)
<i>C. perennis</i> (M. E. Jones) O'Neill	C ₃	KW (A: <i>Gentry 14432</i> US; <i>Purpus 267</i> p.p. US)
<i>C. phillipsiae</i> (C. B. Clarke) Kük., as <i>Mariscus phillipsiae</i> C. B. Clarke	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>C. phleioides</i> (Nees ex Kunth) Hillebr. var. <i>hawaiiensis</i> (H. Mann) Kük.	C ₄	KW (Ac: <i>Alexander 5234</i>)
<i>C. picardae</i> Boeck.	C ₄	KW (Ac: <i>Howard 8842</i> P)
<i>C. pilosus</i> Vahl	C ₄	Ehleringer et al. 1987 (δ ¹³ C); Ueno et al. 1986 (Ac. B); Ueno et al. 1988b (USc); Ueno and Takeda 1992 (A. Γ); KW (Ac: <i>McKee 1547</i> ; <i>Murata T-15902</i> P)
<i>C. plateilema</i> (Steud.) Kük., as <i>Mariscus plateilema</i> Steud.	C ₄	Hesla et al. 1982 (A. δ ¹³ C)
<i>C. platycaulis</i> Baker ^a , as <i>C. platycaulis</i> var. <i>lucenti-nigricans</i> (K. Schum.) Kük. ^b , as <i>C. platycaulis</i> var. <i>serpens</i> (Cherm.) Kük. ^c	C ₃	Druyts-Voets 1970 ([A]) ^{a,b,c} ; Hesla et al. 1982 (δ ¹³ C) ^a
<i>C. platystylis</i> R. Br.	C ₃	Mani 1960 ([A]); Druyts-Voets 1970 ([A]); Takeda et al. 1985 (A); KW (A: <i>Specht 1159</i>); LR (δ ¹³ C: -27.7, <i>Poilane 21428</i>)
<i>C. plukenetii</i> Fernald	C ₄	Li et al. 1999 (A)
<i>C. podocarpus</i> Boeck.	C ₄	KW (Ac: <i>Adam 14957</i> P)
<i>C. portae-tartari</i> K. L. Wilson, as <i>C. ixiocarpus</i> F. Muell. ^a	C ₄	Carolin et al. 1977 (USc) ^a ; KW (Ac: <i>Dunlop 4455</i> ; <i>Jacobs 1527</i>)
<i>C. procerus</i> Rottb. var. <i>vanderystii</i>	C ₄ C ₄	Mani 1960 ([A]); KW (Ac: <i>Auld</i> NSW 84668; <i>Salasoo</i> NSW 91196) Druyts-Voets 1970 ([A])
<i>C. prolifer</i> Lam.	C ₃	Druyts-Voets 1970 ([A]); Hesla et al. 1982 (δ ¹³ C); KW (A: <i>Wilson 4382</i>)
<i>C. prolixus</i> Kunth	C ₄	KW (Ac: <i>Pedersen 9601</i> P); LR (δ ¹³ C: -12.7, <i>Bourgeau s. n.</i> , 1866)
<i>C. pseudoleptocladus</i> Kük. ^a , as <i>C. pseudoleptocladus</i> var. <i>polycarpus</i> Kük. ^b	C ₃	Druyts-Voets 1970 ([A]) ^{a,b} ; Hesla et al. 1982 (δ ¹³ C) ^a ; KW (A: <i>Pawek 6484</i> P) ^a
<i>C. pseudovegetus</i> Steud., as <i>C. pseudovegetus</i> var. <i>pseudovegetus</i> ^s	C ₃	Denton 1983 (A) ^a ; Li et al. 1999 (A)
<i>C. pseudovestitus</i> (C. B. Clarke) Kük. (<i>Mariscus goniobolbus</i> Cherm.), as <i>Mariscus pseudovestitus</i> C. B. Clarke ^a	C ₄	Hesla et al. 1982 (δ ¹³ C) ^a ; Vorster 1990 (A) ^a ; KW (Ac: <i>Bosser 13474</i> P; <i>Vorster 2497</i>)
<i>C. pulchellus</i> R. Br., as <i>C. leucocephalus</i> Retz. var. <i>pulchellus</i> (R. Br.) ined. ^a	C ₃	Druyts-Voets 1970 ([A]) ^a ; Hesla et al. 1982 (δ ¹³ C); Takeda et al. 1985 (A. δ ¹³ C); Simpson 1990 (A); KW (A: <i>Bosser 4654</i> P; <i>McKee 9189</i> P)
<i>C. pulchellus</i>	C ₄ +	LR (δ ¹³ C: -13.2, <i>Gillet 1698</i>)
<i>C. pulcher</i> Thunb.	C ₃	Sonnenberg and Botha 1992 (A. PIB)
<i>C. pustulatus</i> Vahl	C ₄	Druyts-Voets 1970 ([A])
<i>C. pycnostachyus</i> (Kunth) Kunth	C ₄	KW (Ac: <i>Pringle 6313</i> P)
<i>C. pygmaeus</i> Rottb., as <i>C. michelianus</i> subsp. <i>pygmaeus</i> (Rottb.) Aschers. & Graebn. ^a	C ₄	Carolin et al. 1977 (USc); Hesla et al. 1982 (δ ¹³ C); Ueno and Takeda 1992 (A. Γ) ^a ; JB (Ac: <i>H. Eichler 18182</i> CANB); KW (Ac: <i>Beauglehole 46512</i> ; <i>McGillivray 2943</i> ; <i>Solling 486</i> ; <i>Wilson 1465</i>); LR (δ ¹³ C: -13.3, <i>Kotschy 329</i>) ^a
<i>C. radians</i> Nees & Meyen	C ₄	KW (Ac: <i>Petelot 5480, 5602</i> P)
<i>C. reduncus</i> Boeck.	C ₃	Druyts-Voets 1970 ([A])
<i>C. reflexus</i> Vahl, as <i>C. reflexus</i> var. <i>reflexus</i> ^a , as <i>C. reflexus</i> var. <i>fraternus</i> (Kunth) Kuntze ^b	C ₃	Denton 1983 (A) ^{a,b} ; KW (A: <i>Wilson 1441</i>)
<i>C. retroflexus</i> var. <i>pumilus</i> (Britton) R. Carter & S. D. Jones (<i>C. subuniflorus</i> Britton)	C ₄	KW (Ac: <i>Pringle 807</i> P)
<i>C. refractus</i> Engelm. ex Boeck.	C ₄	Li et al. 1999 (A)
<i>C. remotus</i> (C. B. Clarke) Kük., as <i>Mariscus remotus</i> C. B. Clarke	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>C. renschii</i> Boeck.	C ₃	Druyts-Voets 1970 ([A]); Hesla et al. 1982 (δ ¹³ C)
<i>C. retrofractus</i> (L.) Torr.	C ₄	Li et al. 1999 (A); KW (Ac: <i>Radford & Bozeman 11380</i> P)
<i>C. retrorsus</i> Chapm.	C ₄	Li et al. 1999 (A. δ ¹³ C)
<i>C. rhynchosporoides</i> Kük.	C ₄	KW (Ac: <i>Richards 16898</i> P)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>C. rigens</i> J. Presl & C. Presl	C ₄	Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$); KW (Ac: <i>Wilson 1445</i>)
<i>C. rigidellus</i> (Benth.) J. Black, as <i>C. subpinnatus</i> Kük. ^a	C ₄	Takeda et al. 1985 (Ac) ^a ; KW (Ac: <i>Beauglehole 23111; Wilson 742, 1466</i>)
<i>C. rigidifolius</i> Steud.	C ₄	Druyts-Voets 1970 ([A]); Hesla et al. 1982 (A. $\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -12.9, <i>Pappi 2155</i>)
<i>C. rohlfsii</i> Boeck., as <i>Mariscus rohlfsii</i> (Boeck.) C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. rotundus</i> L., as <i>C. rotundus</i> subsp. <i>rotundus</i> ^a	C ₄	Sabnis 1921 ([A]); Mani 1963 ([A]); Akita et al. 1969 ([A]); Chen et al. 1970 (Γ); Druyts-Voets 1970 ([Ac]); Black and Mollenhauer 1971 (Ac); Black et al. 1973 (B); Hofstra et al. 1972 (A. Γ) ^a ; Chen et al. 1974 (A. B); Troughton et al. 1974 ($\delta^{13}\text{C}$); Prakash et al. 1976 (A); Meinzer 1978 (A); Takeda et al. 1980 (Ac. Γ); Borchers et al. 1982 (A); Hesla et al. 1982 ($\delta^{13}\text{C}$); Ueno et al. 1986 (Ac. B); Bruhl et al. 1987 (Ac. B); Li 1993 (A. Γ . $\delta^{13}\text{C}$); Lin et al. 1993 (Ac); Li and Jones 1994 (A); Li et al. 1999 (A. $\delta^{13}\text{C}$); JB (Ac: <i>I. B. Wilson 197 CANB</i>); KW (Ac: <i>Wilson 902</i>)
subsp. <i>merkeri</i> (C. B. Clarke) Kük., as <i>C. merkeri</i> C. B. Clarke ^a	C ₄	Druyts-Voets 1970 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a
<i>C. rubicundus</i> Vahl, as <i>C. teneriffae</i> Poir. ^a	C ₄	Druyts-Voets 1970 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Subko 104 P</i>); LR ($\delta^{13}\text{C}$: -11.8, <i>Schimper 1323</i>) ^a
<i>C. rubiginosus</i> Hook. f.	C ₄	KW (Ac: <i>Hooker s. n. P; Schimpff 14 US; Wheeler et al. 5 US; Wiggins & Porter 568 NY</i>)
<i>C. rupestris</i> Kunth	C ₄	KW (Ac: <i>Biegel 2065 P; Pienaar 271 PRE; Wood 8546</i>)
<i>C. sandwicensis</i> Kük.	C ₄	KW (Ac: <i>Degener 8460 NY</i>)
<i>C. sanguineo-ater</i> Boeck.	C ₄	KW (Ac: <i>Pringle 3844</i>)
<i>C. scaber</i> R. Br., as <i>Mariscus scaber</i> (R. Br.) Boeck. ^a	C ₄	Bruhl et al. 1987 (Ac. B) ^a ; JB (Ac: <i>Bruhl 234, 497 CANB</i>); KW (Ac: <i>McKee 9040 P</i>)
<i>C. scariosus</i> R. Br.	C ₄	Takeda et al. 1985 (Ac. $\delta^{13}\text{C}$)
<i>C. schimperianus</i> Steud., as <i>C. schimperianus</i> var. <i>minor</i> Boeck. ^a	C ₄	Druyts-Voets 1970 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. schomburgkianus</i> Nees	C ₃	Simpson 1990 (A)
<i>C. schweinitzii</i> Torr.	C ₄	Li et al. 1999 (A. $\delta^{13}\text{C}$)
<i>C. secubans</i> K. L. Wilson	C ₄	KW (Ac: <i>Coveny 8812</i>)
<i>C. seemanianus</i> Boeck.	C ₄	KW (Ac: <i>Campbell NSW 22740</i>)
<i>C. semitrifidus</i> Schrad.	C ₄	KW (Ac: <i>Schlechter 2513</i>)
<i>C. serotinus</i> Rottb., as <i>Juncellus serotinus</i> (Rottb.) C. B. Clarke ^a	C ₄	Akita et al. 1969 ([A]); Takeda et al. 1980 (Ac. Γ); Collins and Jones 1985 ($\delta^{13}\text{C}$); Ueno et al. 1986 (Ac. B); Li 1993 (A. Γ . $\delta^{13}\text{C}$); Kalapos et al. 1997 ($\delta^{13}\text{C}$) ^a ; JB (Ac: <i>s. coll. MEL 1543840</i>); KW (Ac: <i>Naito NSW 608949</i>); LR ($\delta^{13}\text{C}$: -13.1, <i>Bourgeau 32</i>)
<i>C. seslerioides</i> Kunth	C ₃	LR ($\delta^{13}\text{C}$: -30.3, <i>Pringle 806</i>)
<i>C. setigerus</i> Torr. & Hook.	C ₄	Li et al. 1999 (A)
<i>C. sexflorus</i> R. Br.	C ₄	KW (Ac: <i>Blake 17534; de Lestang 338; Wilson 5341</i>)
<i>C. socialis</i> C. B. Clarke	C ₄	KW (Ac: <i>Halle 3059 P</i>)
<i>C. solidus</i> Kunth, as <i>Mariscus solidus</i> (Kunth) Vorster var. <i>involutus</i> (C. B. Clarke) Vorster ined. ^a	C ₄	Vorster 1990 (A) ^a ; KW (Ac: <i>Guillaumin s. n., cult. P; Medley Wood 12023</i>)
<i>C. sordidus</i> J. Presl & C. Presl (<i>C. howellii</i> O'Neill & Ben. Ayers)	C ₄	KW (Ac: <i>Mason & Hanna 14594 US</i>)
<i>C. soyauxii</i> Boeck., as <i>Mariscus soyauxii</i> (Boeck.) C. B. Clarke ^a	C ₄	KW (Ac: <i>Adam 1918</i>); LR ($\delta^{13}\text{C}$: -12.8, <i>Adam 1918</i>) ^a
<i>C. sp. (Isolepis humillima)</i> (Benth.) K. L. Wilson)	C ₄	KW (Ac: <i>Clarke 24</i>)
<i>C. sp.</i>	C ₄	Smith and Epstein 1971 ($\delta^{13}\text{C}$)
<i>C. sp. as Cyperus japonicus</i> Makino	C ₄ ⁺	Li and Jones 1994 (A)
<i>C. sp. as Mariscus psilostachys</i> (C. B. Clarke) Kük. (non <i>C. psilostachys</i> Steud.) ^a	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Gillett 12841 P</i>)
<i>C. sp. nov. aff. pedunculatus</i> F. Muell.	C ₃	KW (A: <i>Sharpe 1455</i>)
<i>C. sp. aff. sexflorus</i>	C ₄	Carolin et al. 1977 (USc)
<i>C. speciosus</i> Vahl	C ₄	KW (Ac: <i>Kotov s. n., Transcaucasia P</i>)
<i>C. spectabilis</i> Spreng.	C ₄	KW (Ac: <i>Arsène 5914 P; Pringle 13233</i>)
<i>C. sphacelatus</i> Rottb.	C ₄	Druyts-Voets 1970 ([A])

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>C. sphaerospermus</i> Schrad.	C ₃	KW (A: <i>O'Connor 71 PRE</i>)
<i>C. sporobolus</i> R. Br.	C ₄	KW (Ac: <i>Dunlop 4096</i>)
<i>C. squarrosus</i> L. (<i>Monandrus squarrosus</i> (L.) ined.) ^a , as <i>C. aristatus</i> Rottb. ^b , as <i>C. aristatus</i> var. <i>inflexus</i> ^c , as <i>Mariscus squarrosus</i> (L.) C. B. Clarke ^d	C ₄	Mani 1960 ([A]) ^b ; Druyts-Voets 1970 ([A]) ^{ab} ; Mulroy and Rundel 1977 (A) ^c ; Baskin and Baskin 1981 (A) ^c ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^d ; Takeda et al. 1985 (Ac) ^a ; Li 1993 (A. $\delta^{13}\text{C}$) ^a ; Li et al. 1999 (A. $\delta^{13}\text{C}$) ^a ; JB (Ac: <i>Davidson 347 BRI</i> ; <i>Steele</i> , 6 Aug 1909 BRI); KW (Ac: <i>Wilson 1501</i>); LR ($\delta^{13}\text{C}$: -13.1, <i>Gillet 3272</i>) ^d
<i>C. stenophyllus</i> Valck. Sur.	C ₄	KW (Ac: <i>Schlechter 16700 P</i>)
<i>C. stolonifer</i> Retz.	C ₄	Ueno and Takeda 1992 (A)
<i>C. stradbrogensis</i> Domin	C ₃	KW (A: <i>Johnson 7593</i>)
<i>C. strigosus</i> L., as <i>Mariscus strigosus</i> (L.) C. B. Clarke ^a	C ₄	Lerman and Raynal 1972 (A) ^a ; Li 1993 (A. $\delta^{13}\text{C}$); Li et al. 1999 (A. $\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -12.0, <i>Louis Marie s. n.</i> , 1927) ^a
<i>C. subbadius</i> Kük.	C ₄	KW (Ac: <i>Leroy s. n.</i> , Madagascar P; <i>Decary 644G</i>)
<i>C. sublimis</i> (C. B. Clarke) Dandy, as <i>M. sublimis</i> C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -12.6, <i>Waterlot 1265</i>)
<i>C. submicrolepis</i> Kük.	C ₃	Druyts-Voets 1970 ([A])
<i>C. subparadoxus</i> Kük., as <i>Mariscus paradoxus</i> (Cherm.) Cherm. ^a	C ₄	KW (Ac: <i>Haines 4138 P</i>); LR ($\delta^{13}\text{C}$: -13.5, <i>Haines 4138</i>) ^a
<i>C. subulatus</i> R. Br.	C ₄	KW (Ac: <i>Whittet NSW 65182</i> ; <i>Wilson 1493</i>)
<i>C. subumbellatus</i> Kük., as <i>Mariscus alternifolius</i> Vahl	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a
<i>C. subxerophilus</i> Kük.	C ₃	Druyts-Voets 1970 ([A])
<i>C. surinamensis</i> Rottb.	C ₃	Denton 1983 (A); LR ($\delta^{13}\text{C}$: -28.3, <i>Leblond 40</i>)
<i>C. tabularis</i> Schrad.	C ₄	KW (Ac: <i>Schlechter 10675</i>)
<i>C. tanganyicanus</i> (Kük.) K. Lye, as <i>C. bellus</i> var. <i>tanganyicanus</i> Kük.	C ₄	Druyts-Voets 1970 ([A])
<i>C. tenax</i> Boeck. ^a , as <i>C. tenax</i> var. <i>actinotachys</i> (Welw. ex Ridl.) Kük. ^b	C ₄	Druyts-Voets 1970 ([A]) ^{ab} ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; KW (Ac: <i>Stolz 1046 P</i>) ^a
<i>C. tenellus</i> L. f.	C ₃	Druyts-Voets 1970 ([A]); Takeda et al. 1985 (A. $\delta^{13}\text{C}$)
<i>C. tenerrimus</i> J. Presl & C. Presl	C ₃	Simpson 1990 (A)
<i>C. tenuiculmis</i> Boeck. ^a , as <i>C. zollingeri</i> var. <i>parvus</i> C. B. Clarke ^b , as <i>C. tenuiculmis</i> f. <i>compactus</i> ined. ^c , as <i>C. tenuiculmis</i> var. <i>densior</i> ined. ^d	C ₄	Druyts-Voets 1970 ([A]) ^{abc,d} ; KW (Ac: <i>Audru 3760 P</i> ; <i>Wilson 3819</i>) ^a ; LR ($\delta^{13}\text{C}$: -11.9, <i>Hooker s. n.</i> , India 1853) ^a
var. <i>tenuiculmis</i> , as <i>C. tenuiculmis</i> var. <i>longiramulosus</i> Kük.	C ₄	Druyts-Voets 1970 ([A])
var. <i>schweinfurthianus</i> (Boeck.) S. S. Hooper, as <i>C. schweinfurthianus</i> Boeck.	C ₄	Druyts-Voets 1970 ([A])
<i>C. tenuis</i> var. <i>luridus</i> (C. B. Clarke) Kük., as <i>Mariscus luridus</i> C. B. Clarke (non <i>C. luridus</i> Govindarajalu)	C ₄	LR ($\delta^{13}\text{C}$: -12.3, <i>Chevalier 23601</i>)
<i>C. tenuispica</i> Steud.	C ₃	Mani 1960 ([A]); Druyts-Voets 1970 ([A]); Nautiyal and Das 1982 ([A]); Ueno and Takeda 1992 (A); LR ($\delta^{13}\text{C}$: -28.1, <i>Jacques-Félix 7241</i>)
<i>C. tenuispiculatus</i> Boeck.	C ₄	KW (Ac: <i>de la Bâthie</i> , Madagascar Apr 1928 P)
<i>C. tetracarpus</i> Boeck.	C ₄	KW (Ac: <i>Blake 15581</i>)
<i>C. textilis</i> Thunb.	C ₃	Druyts-Voets 1970 ([A])
	C ₄ ⁺	Li 1993 (A)
<i>C. thomsonii</i> Boeck.	C ₄	KW (Ac: <i>Balansa 2836 P</i>)
<i>C. thunbergii</i> Vahl	C ₄	KW (Ac: <i>Humbert 10215 P</i>)
<i>C. thyrsiflorus</i> Junghuhn	C ₄	KW (Ac: <i>Fisher NSW 608977</i>)
<i>C. tomaiophyllus</i> K. Schum., as <i>Mariscus tomaiophyllus</i> (K. Schum.) C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -11.9, <i>Humbert 8639</i>)
<i>C. tonkinensis</i> C. B. Clarke	C ₄	KW (Ac: <i>Tixier 11 P</i>)
var. <i>baikiei</i> (C. B. Clarke ex Kük.) S. S. Hooper, as <i>C. baikiei</i> C. B. Clarke ex Kük.	C ₄	Druyts-Voets 1970 ([Ac])
<i>C. trachysanthos</i> Hook. & Arn.	C ₄	KW (Ac: <i>Degener 11059 BRI</i> ; <i>Forbes 2359.0 P</i>)
<i>C. trichodes</i> Griseb.	C ₄	KW (Ac: <i>Harris 12882 NY</i> ; <i>Proctor 34283 NY</i>)
<i>C. tuberosus</i> Rottb., as <i>C. rotundus</i> subsp. <i>tuberosus</i> (Rottb.) Kük. ^a	C ₄	Druyts-Voets 1970 ([Ac]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (Ac)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>C. turrillii</i> Kük., as <i>Mariscus laxiflorus</i> Turrill ^a	C ₄	KW (Ac: <i>Koechlin 5313</i> P); SCV ($\delta^{13}\text{C}$: -10.55, <i>Rogers 7006</i>) ^a
<i>C. uncinulatus</i> Schrad. ex Nees	C ₃	LR ($\delta^{13}\text{C}$: -27.4, <i>Weddell 3056</i>)
<i>C. undulatus</i> Kük.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. usitatus</i> Burch.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
var. <i>stuhlmannii</i> (C. B. Clarke) K. Lye, as <i>Cyperus stuhlmannii</i> C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>C. ustulatus</i> A. Rich.	C ₄	Troughton et al. 1974 ($\delta^{13}\text{C}$)
<i>C. vaginatus</i> R. Br.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); KW (A: <i>Payne 20</i> ; <i>Wilson 1354</i>)
<i>C. varicus</i> (C. B. Clarke) Kük.	C ₄	KW (Ac: <i>Decary 10649</i> P)
<i>C. vestitus</i> Krauss, as <i>Mariscus vestitus</i> (Krauss) C. B. Clarke	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); SCV ($\delta^{13}\text{C}$: -9.99, <i>Acocks 21042</i>)
<i>C. victoriensis</i> C. B. Clarke	C ₄	Carolin et al. 1977 (USc); Takeda et al. 1985 (Ac); KW (Ac: <i>Payne 19</i>)
<i>C. virens</i> Michx., as <i>C. virens</i> var. <i>virens</i> ^a	C ₃	Denton 1983 (A) ^a ; LR ($\delta^{13}\text{C}$: -29.4, <i>Curtis 5238</i>)
var. <i>minarum</i> (Boeck.) Denton	C ₃	Denton 1983 (A)
var. <i>montanus</i> (Boeck.) Denton	C ₃	Denton 1983 (A)
<i>C. viscidulus</i> K. L. Wilson	C ₄	KW (Ac: <i>Beauglehole 47687</i> ; <i>Dunlop 5231</i>)
<i>C. vorsteri</i> K. L. Wilson, as <i>Mariscus grantii</i> C. B. Clarke	C ₄	Vorster 1990 (A)
<i>C. zollingeri</i> Steud., as <i>C. rubroviridis</i> Cherm.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>Cypringlea analecta</i> (Beetle) M. T. Strong	C ₃	BW (A: <i>Lyonet 1318</i> US; <i>Pringle 3175</i> US; <i>Purpus 2889</i> US)
<i>Desmoschoenus spiralis</i> (A. Rich.) Hook. f.	C ₃	JB (A: <i>Clifford</i> , 17 Nov 1973 BRI. $\delta^{13}\text{C}$: -24.6, <i>Clifford</i> , 17 Nov 1973); LR ($\delta^{13}\text{C}$: -24.7, <i>Hombroen s. n.</i> , ca. 1840)
<i>Didymiandrum stellatum</i> (Boeck.) Gilly	C ₃	JB (A: <i>Prance 9789</i> K)
<i>Diplacrum africanum</i> C. B. Clarke	C ₃	JB (A: <i>Schweinfurth 2573</i> BRI); LR ($\delta^{13}\text{C}$: -29.1, <i>Jacques-Félix 7328</i>)
<i>D. caricinum</i> R. Br., as <i>Scleria caricina</i> (R. Br.) Benth. ^a	C ₃	Govindarajalu 1975a ([A]) ^a ; JB (A: <i>Brass 19343</i> CANB; <i>Schweinfurth 2573</i> BRI)
<i>D. pygmaeum</i> (R. Br.) Nees ex Boeck., as <i>Scleria pygmaea</i> R. Br. ^a	C ₃	Takeda et al. 1985 (A) ^a ; JB (A: <i>Bruhl 304</i> CANB)
<i>Diplasia karataefolia</i> Rich. ex Pers.	C ₃	Koyama 1967 ([A]); Metcalfe 1971 ([A]); JB (A: <i>Croat 17547</i>)
<i>Dulichium arundinaceum</i> (L.) Britton, as <i>Dulichium</i> ^a	C ₃	Lerman and Raynal 1972 (A) ^a ; JB (A: <i>Smith</i> , 25 Aug 1946 BRI); LR ($\delta^{13}\text{C}$: -30.7, <i>Barkley Bogdan 380028</i>)
<i>Eglaria fluctuans</i> L. T. Eiten	C ₃	JB (A: <i>Ducke</i> , 20 July 1912 BRI. $\delta^{13}\text{C}$: -25.6, -27.6, <i>Ducke</i> , 20 July 1912 BRI)
<i>Eleocharis acicularis</i> (L.) Roem. & Schult.	C ₃	Akita et al. 1969 ([A]); Sternberg et al. 1984 ($\delta^{13}\text{C}$); Keeley et al. 1986 ($\delta^{13}\text{C}$); Ueno et al. 1989 (A. $\delta^{13}\text{C}$); Ueno and Takeda 1992 (A); Lin et al. 1993 (A); JB (A: MEL 1543839; MEL 1543860)
<i>E. acuta</i> R. Br.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); Bruhl et al. 1987 (A. B); Ueno et al. 1989 (A); Bruhl and Perry 1995 (US); JB (A: <i>Phillips 2841761</i> CANB; <i>Bruhl 33</i> , <i>74</i> , <i>125</i> CANB. $\delta^{13}\text{C}$: 44, <i>Bruhl 74</i> ; 47, <i>Bruhl 33</i> ; 47, <i>Bruhl 125</i> . $\delta^{13}\text{C}$: -28.2, <i>Bruhl 125</i> ; -28.4, <i>Bruhl 125</i>)
<i>E. acutangula</i> (Roxb.) Roem. & Schult., as <i>E. fistulosa</i> (Poir.) Link ^a	C ₃	Govindarajalu 1975a ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Ueno et al. 1989 (A) ^a ; Ueno and Takeda 1992 (A) ^a ; KW (A: <i>Blake 9371</i>); LR ($\delta^{13}\text{C}$: -27.3, <i>Smith 6710</i>)
<i>E. acutisquamata</i> Buckley	C ₃	Ueno et al. 1989 (A)
<i>E. albibractea</i> Nees & Meyen	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. albida</i> Torr.	C ₃	Ueno et al. 1989 (A)
<i>E. alveolata</i> Svenson	C ₄	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. amazonica</i> C. B. Clarke	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. ambigens</i> Fernald	C ₃	Ueno et al. 1989 (A)
<i>E. atricha</i> R. Br.	C ₃	Takeda et al. 1985 (A); JB (A: <i>Beauglehole 6525</i> CANB)
<i>E. atropurpurea</i> (Retz.) Presl	C ₃	Govindarajalu 1975a ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (A); Ueno et al. 1989 (A); Ueno and Takeda 1992 (A); JB (A: <i>Latz 2226</i> CANB); SCV ($\delta^{13}\text{C}$: -26.90, <i>Schlieben 6398</i>)
<i>E. attenuata</i> (Franch. & Sav.) Palla	C ₃	Ueno and Takeda 1992 (A); JB (A: <i>Flemlley ANU 2536</i> CANB)
<i>E. bahamensis</i> Boeck.	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. baldwinii</i> (Torr.) Chapm.	C ₄	Uchino et al. 1995 (A (T); [e]. B(T). B ¹⁴ C pulse- ¹² C chase (T)); Ueno and Samejima 1989 (B); Ueno et al. 1989 (A. $\delta^{13}\text{C}$); Ueno and Samejima 1990 ($\delta^{13}\text{C}$)
	C ₄ & C ₄ -like C ₃	Uchino et al. 1995 (A [S]; [e]. B [S]. B ¹⁴ C pulse- ¹² C chase [S]); Ueno 2004 (A. B. B [antiserum]. B [IL]. B [kinetics]. US: NAD)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
	C ₃ -C ₄	Ueno and Samejima 1990 ($\delta^{13}\text{C}$)
	C ₃	Ueno and Samejima 1990 ($\delta^{13}\text{C}$)
<i>E. bella</i> (Piper) Svenson	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. bolanderi</i> A. Gray	C ₃	Ueno et al. 1989 (A)
<i>E. bonariensis</i> Nees	C ₃	Ueno et al. 1989 (A)
<i>E. brassii</i> S. T. Blake	C ₃	Takeda et al. 1985 (A); KW (A: <i>Wilson 5318, 5375</i>)
<i>E. caespitosissima</i> J. G. Baker	C ₄	Bruhl et al. 1987 (Ae. B); Bruhl and Perry 1995 (USe); JB (Ae, <i>Dunlop 4212 CANB</i> ; Bruhl 356, 357, 365, 399, 409 CANB. Γ : 1, <i>Bruhl 356</i> ; 1, <i>Bruhl 375</i> ; 1, <i>Bruhl 375</i> . $\delta^{13}\text{C}$: -13.0, -13.6, <i>Bruhl 356</i>)
<i>E. cancellata</i> S. Wats.	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$); JB (A: <i>Pringle 3269 MEL</i>)
<i>E. capillacea</i> Kunth	C ₃	Ueno et al. 1989 (A)
<i>E. cellulosa</i> Torr.	C ₃	Ueno et al. 1989 (A)
<i>E. compressa</i> Sull.	C ₃	Ueno et al. 1989 (A)
<i>E. congesta</i> D. Don	C ₃	Govindarajalu 1975a ([A]); Ueno et al. 1989 (A. $\delta^{13}\text{C}$); Ueno 2004 (B [kinetics]); JB (A: <i>Uva</i> , Sep 1890 PDA)
subsp. <i>japonica</i> (Miq.) Koyama	C ₃	Ueno and Takeda 1992 (A. Γ); JB (A: <i>?Koniegalle 1867 PDA</i>)
<i>E. crinalis</i> (Griseb.) C. B. Clarke	C ₃	Ueno et al. 1989 (A)
<i>E. cylindrica</i> Buckley	C ₃ -C ₄	Guaglianone and Ueno 1990 (A)
as <i>E. spagazzinii</i> Barros	C ₃ -C ₄ ?	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. cylindrostachys</i> Boeck.	C ₃	Ueno et al. 1989 (A)
<i>E. debilis</i> Kunth	C ₃	Ueno et al. 1989 (A)
<i>E. decumbens</i> C. B. Clarke	C ₃	Ueno et al. 1989 (A)
<i>E. densa</i> Benth.	C ₃	Ueno et al. 1989 (A)
<i>E. dietrichiana</i> Boeck.	C ₃	Ueno et al. 1989 (A)
<i>E. dombeyana</i> Kunth	C ₃	Ueno et al. 1989 (A)
<i>E. dulcis</i> (Burm. f.) Hensch.	C ₃	Takeda et al. 1985 (A); Ueno and Takeda 1992 (A); Ueno et al. 1989 (A. $\delta^{13}\text{C}$); Ellery et al. 1992 ($\delta^{13}\text{C}$); JB (A: <i>Dharmawardhana 14 CANB. Γ: 49, Dharmawardhana 14</i>); KW (A: <i>Wilson 5005, 5097a</i>)
<i>E. dunensis</i> Kük.	C ₃	Ueno et al. 1989 (A)
<i>E. elegans</i> (Kunth) Roem. & Schult.	C ₃	Ueno et al. 1989 (A)
<i>E. elliptica</i> Kunth	C ₃	Ueno et al. 1989 (A)
<i>E. elongata</i> Chapm.	C ₃	Ueno et al. 1989 (A)
<i>E. engelmannii</i> Steud.	C ₃	Ueno et al. 1989 (A)
<i>E. equisetina</i> J. Presl & C. Presl	C ₃	Takeda et al. 1985 (A); KW (A: <i>Constable 6535; Wilson 3825</i>)
<i>E. equisetoides</i> (Elliott) Torr.	C ₃	Ueno et al. 1989 (A)
<i>E. erythropoda</i> Steud., as <i>E. calva</i> Torr. [nom. inval.]	C ₃	Ueno et al. 1989 (A)
<i>E. exigua</i> (Kunth) Roem. & Schult.	C ₃ ?	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. filiculmis</i> Kunth	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. flavescens</i> (Poir.) Urban	C ₃	Ueno et al. 1989 (A)
var. <i>olivacea</i> (Torr.) Gleason, as <i>E. olivacea</i> Torr.	C ₃	Ueno et al. 1989 (A)
<i>E. geniculata</i> (L.) Roem. & Schult. ^a , as <i>E. caribaea</i> (Rottb.) S. F. Blake ^b	C ₃	Govindarajalu 1975a ([A]); Takeda et al. 1985 (A) ^{a,b} ; Bruhl et al. 1987 (A. B); Ueno et al. 1989 (A); Ueno and Takeda 1992 (A); Bruhl and Perry 1995 (US); JB (A: <i>Bruhl 231 CANB. Γ: 51, Bruhl 231</i> . $\delta^{13}\text{C}$: -28.1, <i>Bruhl 231</i>); LR ($\delta^{13}\text{C}$: -29.8, <i>Sintenis 1968</i>)
<i>E. glauca</i> Boeck.	C ₄	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. gracilis</i> R. Br., as <i>E. cunninghamii</i> Boeck. ^a	C ₃	Takeda et al. 1985 (A); Ueno et al. 1989 (A) ^a
<i>E. grisea</i> Kük.	C ₃	Ueno et al. 1989 (A)
<i>E. haumaniana</i> Barros	C ₃	Ueno et al. 1989 (A)
<i>E. intermedia</i> Schult.	C ₃	Ueno et al. 1989 (A)
<i>E. interstincta</i> (Vahl) Roem. & Schult.	C ₃	Eiten 1969 ([A]); Ueno et al. 1989 (A)
<i>E. intricata</i> Kük.	C ₃	Ueno et al. 1989 (A); JB (A: <i>Arnold 470 PRE</i>)
<i>E. kamschatica</i> (C. A. Mey.) Komarov	C ₃	Ueno et al. 1989 (A); Ueno and Takeda 1992 (A)
<i>E. kuroguwai</i> Ohwi	C ₃	Akita et al. 1969 ([A]); Ueno and Takeda 1992 (A. Γ)
<i>E. lanceolata</i> Fernald	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. limosa</i> (Schrad.) Schult.	C ₃	Ueno et al. 1989 (A); SCV ($\delta^{13}\text{C}$: -26.17, <i>Flanagan 903</i>)
× <i>E. macounii</i> Fernald (= <i>E. intermedia</i> Schult. × <i>E. obtusa</i> (Willd.) Schult.)	C ₃	Ueno et al. 1989 (A)
<i>E. macrostachya</i> Britton	C ₃	Keeley et al. 1986 ($\delta^{13}\text{C}$); Ueno et al. 1989 (A)
<i>E. maculosa</i> (Vahl) Roem. & Schult.	C ₃	Ueno et al. 1989 (A)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>E. mamillata</i> (Lindb.) Lindb.	C ₃	Ueno et al. 1989 (A); Ueno and Takeda 1992 (A)
<i>E. margaritacea</i> (Hulten) Miyabe & Kudo	C ₃	Ueno and Takeda 1992 (A)
<i>E. marginulata</i> Steud.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>E. melanocarpa</i> Torr.	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. melanostachys</i> (Urville) C. B. Clarke	C ₃	Ueno et al. 1989 (A)
<i>E. microcarpa</i> Torr.	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. minarum</i> Boeck.	C ₃	Ueno et al. 1989 (A)
<i>E. minima</i> Kunth	C ₄	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. minuta</i> Boeck.	C ₃	Ueno et al. 1989 (A); JB (A: <i>Bruhl 201</i> CANB. Γ : 47, <i>Bruhl 201</i> . $\delta^{13}\text{C}$: -28.0, <i>Bruhl 201</i>)
<i>E. minutissima</i> Britton	C ₃	Ueno et al. 1989 (A)
<i>E. mitracarpa</i> Steud.	C ₃	Ueno et al. 1989 (A)
<i>E. mitrata</i> (Griseb.) C. B. Clarke	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. montana</i> (Kunth) Roem. & Schult., as <i>E. nodulosa</i> (Roth) Schult.	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. montevidensis</i> Kunth ^a , as <i>E. palmeri</i> Svenson ^b	C ₃	Ueno et al. 1989 (A) ^{ab}
<i>E. multicaulis</i> Sm.	C ₃	Ueno et al. 1989 (A)
<i>E. mutata</i> (L.) Roem. & Schult.	C ₃	Ueno et al. 1989 (A); LR ($\delta^{13}\text{C}$: -27.4, <i>Mélinon 13</i>)
<i>E. nana</i> Kunth	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. naumanniana</i> Boeck.	C ₃	JB (A: <i>Smith 2988</i> PRE)
<i>E. nervata</i> Svenson	C ₃	Ueno et al. 1989 (A)
<i>E. nigrescens</i> (Nees) Steud.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$); Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. nitida</i> Fernald	C ₃	Ueno et al. 1989 (A); JB (A: <i>Fernald 328</i> MEL)
<i>E. nuda</i> C. B. Clarke	C ₃	Ueno et al. 1989 (A)
<i>E. nudipes</i> (Kunth) Palla	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. nupeensis</i> Hutch. & Dalziel	C ₃	Ueno et al. 1989 (A)
<i>E. obicis</i> L. Johnson & O. Evans	C ₃	KW (A: <i>Wilson 5655</i>)
<i>E. obtusa</i> (Willd.) Schult.	C ₃	Ueno et al. 1989 (A)
<i>E. ochrostachys</i> Steud.	C ₃	JB (A: <i>Dharmawardhana 17</i> CANB. Γ : 47, <i>Dharmawardhana 17</i>)
<i>E. oligantha</i> C. B. Clarke	C ₃	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. ovata</i> (Roth) Roem. & Schult.	C ₃	Ueno et al. 1989 (A); Ueno and Takeda 1992 (A)
<i>E. pachycarpa</i> E. Desv.	C ₃ ?	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. pachystyla</i> (C. Wright) C. B. Clarke	C ₃ ?	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. pallens</i> S. T. Blake	C ₃	Takeda et al. 1985 (A); JB (A: <i>Bruhl 33, 246</i> CANB. Γ : 45, <i>Bruhl 246</i>)
<i>E. palustris</i> (L.) Roem. & Schult. ^a , as <i>E. smallii</i> Britton ^b	C ₃	Ueno et al. 1989 (A ^{ab} . $\delta^{13}\text{C}^b$); LR ($\delta^{13}\text{C}$: -27.3, <i>Buchet s. n.</i> , 1853)
<i>E. palustris</i> subsp. <i>parvinux</i> (Ohwi) T. Koyama	C ₃	Ueno and Takeda 1992 (A)
<i>E. parishii</i> Britton	C ₃	Ueno et al. 1989 (A)
<i>E. parodii</i> Barros	C ₃	Ueno et al. 1989 (A)
<i>E. parvula</i> (Roem. & Schult.) Link ex Bluff	C ₃	Bender 1971 ($\delta^{13}\text{C}$); Ueno et al. 1989 (A); LR ($\delta^{13}\text{C}$: -24.5, <i>Bourgeau 453</i>)
<i>E. pellucida</i> J. Presl & C. Presl	C ₃	Ueno et al. 1989 (A)
<i>E. philippinensis</i> Svenson	C ₃	KW (A: <i>Wilson 3587</i>)
<i>E. plana</i> S. T. Blake	C ₃	Takeda et al. 1985 (A)
<i>E. plicarhachis</i> (Griseb.) Svenson	C ₃	Ueno et al. 1989 (A)
<i>E. pusilla</i> R. Br.	C ₃ -C ₄ ? C ₃ -like C ₃ -C ₄	Bruhl et al. 1987 (A. B) Bruhl and Perry 1995 (US); JB (A: <i>Anderson 45, 384, 1667, 1678</i> CANB; <i>Canning 3543A</i> CANB; <i>Eichler 15636</i> CANB; <i>Gaubia 347, 2422</i> CANB; <i>Moore 799</i> CANB. Γ : 29, <i>Bruhl 179</i> CANB; 29, 30, 31, <i>Bruhl 682</i> CANB. $\delta^{13}\text{C}$: -26.7, <i>Bruhl 179</i>)
<i>E. quadrangulata</i> (Michx.) Roem. & Schult.	C ₃	Ueno et al. 1989 (A)
<i>E. quinquangularis</i> Boeck.	C ₃ -C ₄ ?	Ueno et al. 1989 (A. $\delta^{13}\text{C}$)
<i>E. quinqueflora</i> (Hartmann) O. Schwarz, as <i>E. pauciflora</i> (Lightf.) Link ^a	C ₃	Boutton et al. 1980 (A) ^a ; Ueno et al. 1989 (A) ^a
<i>E. radicans</i> (Poir.) Kunth	C ₃	Ueno et al. 1989 (A)
<i>E. retroflexa</i> (Poir.) Urb.	C ₃ +	Govindarajalu 1975a (IA)
subsp. <i>chaetaria</i> (Roem. & Schult.) T. Koyama	C ₄	Ueno and Samejima 1989 (B); Ueno et al. 1989 (A. $\delta^{13}\text{C}$); Ueno 2004 (B. B [antiserum]); JB (Ae, <i>Sonder 187</i> MEL 1543842. $\delta^{13}\text{C}$: -10.4, -10.9, <i>Sonder 187</i>)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
subsp. <i>retroflexa</i> , as <i>E. retroflexa</i> ^a	C ₄	Bruhl et al. 1987 (Ae. B) ^a ; Ueno et al. 1989 (A. δ ¹³ C); Bruhl and Perry 1995 (USE); Soros and Dengler 2001 (Ae); JB (Ae, <i>Blake 14421</i> CANB; <i>Godwin C.2967</i> CANB. δ ¹³ C: -12.9, -12.9, <i>Godwin C.2967</i>)
subsp. <i>subtilissima</i> (Nelmes) K. Lye	C ₄	JB (Ae, <i>Ellery 15</i> PRE. δ ¹³ C: -14.4, -14.7, <i>Ellery 15</i>)
<i>E. reverchonii</i> Svenson	C ₃ -C ₄ ?	Ueno et al. 1989 (A. δ ¹³ C)
<i>E. robbinsii</i> Oakes	C ₃	Ueno et al. 1989 (A)
<i>E. rostellata</i> (Torr.) Torr.	C ₃	Ueno et al. 1989 (A. δ ¹³ C)
<i>E. schaffneri</i> Boeck.	C ₃	Ueno et al. 1989 (A)
<i>E. schlechteri</i> C. B. Clarke	C ₃	JB (A: <i>Schlechter 3829</i> PRE)
<i>E. schweinfurthiana</i> Boeck.	C ₃	Ueno et al. 1989 (A. δ ¹³ C)
<i>E. sellowiana</i> Kunth	C ₃	Ueno et al. 1989 (A)
<i>E. setifolia</i> (A. Rich.) J. Raynal	C ₃	JB (A: <i>Latz 2751</i> CANB)
<i>E. sintenisii</i> Boeck.	C ₃	Ueno et al. 1989 (A)
<i>E. sp.</i> (?cf. <i>acuta</i>), as <i>E. carniolica</i> C. Koch	C ₃	Ueno et al. 1989 (A)
<i>E. sp. aff. nuda</i> (Wilson 5245)	C ₃	KW (A: <i>Wilson 5012</i>)
<i>E. sp. aff. ochrostachys</i> (Wilson 5166)	C ₃	KW (A)
<i>E. sp. aff. variegata</i> (Wilson 5248)	C ₃	KW (A: <i>Wilson 5160</i>)
<i>E. sphacelata</i> R. Br.	C ₃	Takeda et al. 1985 (A. δ ¹³ C); Bruhl et al. 1987 (A. B); Ueno et al. 1989 (A); JB (A: <i>Bruhl 124, 579</i> CANB. Γ: 42, <i>Bruhl 124, 51, Bruhl 579</i>); KW (A: <i>Coveny 5031; Wilson 2075</i>)
<i>E. spiralis</i> (Rottb.) Roem. & Schult.	C ₃	Govindarajalu 1975a ([A]); Takeda et al. 1985 (A. δ ¹³ C); Ueno et al. 1989 (A); KW (A: <i>Wilson 3666, 5097</i>)
<i>E. squamigera</i> Svenson	C ₃	Ueno et al. 1989 (A)
<i>E. stenocarpa</i> Svenson	C ₃	Ueno et al. 1989 (A)
<i>E. subarticulata</i> (Nees) Boeck.	C ₃	Ueno et al. 1989 (A)
<i>E. subcancellata</i> C. B. Clarke	C ₄	JB (Ae, <i>Pringle 4339</i> MEL 1543837, 1543838. δ ¹³ C: -11.3, -13.0, <i>Pringle 4339</i> MEL 1543837, -11.4, -11.9, <i>Pringle 4339</i> MEL 1543838)
	C ₃ +	Ueno et al. 1989 (A. δ ¹³ C)
<i>E. sundaica</i> Kern	C ₃	KW (A: <i>Wilson 5011, 5165</i>)
<i>E. tenuis</i> (Willd.) Schult.	C ₃	Ueno et al. 1989 (A)
<i>E. tetraquetra</i> Nees	C ₃	Govindarajalu 1975a ([A]); Ueno and Takeda 1992 (A); JB (A: <i>Bruhl 672</i> CANB. Γ: 41, <i>Bruhl 672</i>)
<i>E. tortilis</i> (Link) Schult.	C ₃	Ueno et al. 1989 (A. δ ¹³ C)
<i>E. tricostata</i> Torr.	C ₃	Ueno et al. 1989 (A)
<i>E. tuberculosa</i> (Michx.) Roem. & Schult.	C ₃	Ueno et al. 1989 (A. δ ¹³ C); LR (δ ¹³ C: -30.1, [collector's name obscured] 1919 Louisiana)
<i>E. tucumanensis</i> Barros	C ₃	Guaglianone et al. 1998 (A)
<i>E. uniglumis</i> (Link) Schult. ^a , as <i>E. halophylla</i> (Fernald & Brackett) Fernald ^b	C ₃	Ueno et al. 1989 (A) ^{ab}
<i>E. variegata</i> (Poir.) C. Presl	C ₃	Ueno et al. 1989 (A)
<i>E. viridans</i> Kük.	C ₃	Ueno et al. 1989 (A. δ ¹³ C)
<i>E. vivipara</i> Link.	C ₄	Ueno et al. 1988a (A. B. δ ¹³ C); Ueno et al. 1989 (A. δ ¹³ C); Ueno and Samejima 1990 (δ ¹³ C); Soros and Dengler 2001 (Ae)
	C ₃ & C ₄ +	Ueno 1996 (A. US: NAD); Ueno 1998b (A. B. US); Ueno 2004 (B. B [anti-serum]. B [kinetics])
	C ₃ +	Ueno et al. 1988a (A. B); Ueno and Samejima 1990 (δ ¹³ C)
<i>E. wichurai</i> Boeck.	C ₃	Ueno and Takeda 1992 (A. Γ)
<i>E. wolfii</i> (A. Gray) A. Gray ex Britton	C ₃	Ueno et al. 1989 (A. δ ¹³ C)
<i>Epischoenus adnatus</i> Levyns	C ₃	LR (δ ¹³ C: -27.3, <i>Schlechter 7402</i>)
<i>E. cernuus</i> Levyns	C ₃	SCV (δ ¹³ C: -24.73, <i>Levyns 8873</i>)
<i>E. complanatus</i> Levyns	C ₃	JB (A: <i>Esterhuysen 17776</i> PRE; <i>Stokoe 2162</i> PRE); SCV (δ ¹³ C: -26.21, <i>Esterhuysen 11575</i>)
<i>E. dregeanus</i> (Boeck.) Levyns	C ₃	SCV (δ ¹³ C: -24.45, <i>Levyns 9379</i>)
<i>E. gracilis</i> Levyns	C ₃	JB (A: <i>Esterhuyen 27597</i> PRE)
<i>E. lucidus</i> (C. B. Clarke) Levyns	C ₃	SCV (δ ¹³ C: -25.20, <i>Esterhuysen 11312</i>)
<i>E. villosus</i> Levyns	C ₃	SCV (δ ¹³ C: -22.07, <i>Esterhuysen 16927</i>)
<i>Eriophorum angustifolium</i> Honckeney	C ₃	Bender 1971 (δ ¹³ C); JB (A: <i>Watson</i> , 9 July 1987 pickled fragments at RSBS, ANU)
<i>E. comosum</i> (Wall.) Wall. ex Nees (<i>Erioscirpus comosus</i> (Wall.) Palla)	C ₃	Sharma 1973 ([A]); JB (A: <i>Singh 189</i>)
<i>E. latifolium</i> Hoppe	C ₃	LR (δ ¹³ C: -29.6, <i>Bec in Arènes 1222</i>)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>E. microstachyum</i> Boeck. (<i>Erioscirpus microstachyus</i> (Boeck.) Palla)	C ₃	JB (A: Parker 2785)
<i>E. virginicum</i> L. (<i>Eriophoropsis virginica</i> (L.) Palla)	C ₃	JB (A: Knowlton, NSW 709552; Roy 3950)
<i>Evandra aristata</i> R. Br.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -28.5, Drummond 397)
<i>E. pauciflora</i> R. Br.	C ₃	JB (A: Royce 2683 BRI. $\delta^{13}\text{C}$: -28.0, Royce 2683)
<i>Everardia montana</i> Ridl.	C ₃	LR ($\delta^{13}\text{C}$: -28.2, Wurdeck 1380)
<i>E. montana</i> subsp. <i>duidae</i> (Gilly) T. Koyama & Maguire	C ₃	JB (A: Steyermark 93322 K)
<i>Exocarya sclerioides</i> (F. Muell.) Benth.	C ₃	Koyama 1967 ([A]); Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: Brass 18277 CANB; Jones 3437 CANB)
<i>Exochogyne amazonica</i> C. B. Clarke	C ₃	JB (A: Steyermark, 1 Sep 1961 BRI. $\delta^{13}\text{C}$: -26.9, Steyermark, 1 Sep 1961)
<i>Ficinia acuminata</i> (Nees) Nees	C ₃	SCV ($\delta^{13}\text{C}$: -25.40, Levyns 11212)
<i>F. angustifolia</i> C. B. Clarke	C ₃	JB (A: Esterhuysen 90877 K); SCV ($\delta^{13}\text{C}$: -24.20, Esterhuysen 26427)
<i>F. capillifolia</i> C. B. Clarke	C ₃	JB (A: Fourcade 3017 K)
<i>F. elongata</i> Boeck.	C ₃	JB (A: Stirton 6382 K)
<i>F. fascicularis</i> Nees	C ₃	JB (A: Acocks 9090 K)
<i>F. filiformis</i> (Lam.) Schrad.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>F. gracilis</i> (Poir.) Schrad.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>F. gydomontana</i> Arnold	C ₃	SCV ($\delta^{13}\text{C}$: -21.20, Esterhuysen 27706)
<i>F. indica</i> (Lam.) H. Pfeiff.	C ₃	LR ($\delta^{13}\text{C}$: -26.8, Schlechter 8402)
<i>F. nodosa</i> (Rottb.) Goetgh., A. M. Muasya & D. A. Simpson, as <i>Scirpus nodosus</i> Rottb.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$)
<i>F. pallens</i> (Schrad.) Nees var. <i>lithosperma</i> (Boeck.) Arnold	C ₃	JB (A: Arnold 1007 K)
<i>F. radiata</i> (L.) Kunth (<i>Sickmannia radiata</i> (L. f.) Nees)	C ₃	JB (A: Arnold 965 PRE)
<i>F. stolonifera</i> Boeck.	C ₃	SCV ($\delta^{13}\text{C}$: -25.31, Levyns 6863)
<i>Fimbristylis acicularis</i> R. Br.	C ₄	Takeda et al. 1985 (Af)
<i>F. acuminata</i> Vahl, as <i>F. rhyticarya</i> F. Muell.	C ₄	Takeda et al. 1985 ($\delta^{13}\text{C}$)
<i>F. aestivalis</i> (Retz.) Vahl	C ₄	Akita et al. 1969 ([A]); Kuoh and Chiang 1984 (A); Takeda et al. 1985 (Af); Bruhl et al. 1987 (Af. B); Ehleringer et al. 1987 ($\delta^{13}\text{C}$)
<i>F. annua</i> (Allioni) Roem. & Schult.	C ₄	Ehleringer et al. 1987 ($\delta^{13}\text{C}$)
<i>F. aphylla</i> Steud.	C ₄	LR ($\delta^{13}\text{C}$: -12.7, Tisserant 3330)
<i>F. autumnalis</i> (L.) Roem. & Schult.	C ₄	Ueno and Takeda 1992 (A. Γ)
<i>F. bisumbellata</i> (Forsk.) Bubani	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (Af. $\delta^{13}\text{C}$); Ueno and Takeda 1992 (A)
<i>F. bivalvis</i> (Lam.) K. Lye (<i>F. longiculmis</i> Steud.)	C ₄	SCV ($\delta^{13}\text{C}$: -10.05, Rogers 4563)
<i>F. caespitosa</i> R. Br.	C ₄	Takeda et al. 1985 (Af)
<i>F. caroliniana</i> (Lam.) Fernald	C ₄	Brown 1975 (Af)
<i>F. cephalophora</i> F. Muell.	C ₄	Takeda et al. 1985 (Af)
<i>F. compacta</i> Turill	C ₄	Takeda et al. 1985 (Af. $\delta^{13}\text{C}$)
<i>F. complanata</i> (Retz.) Link	C ₄	Sharma and Mehra 1972 ([A]); Hesla et al. 1982 (A. $\delta^{13}\text{C}$); Ehleringer et al. 1987 ($\delta^{13}\text{C}$); Ueno et al. 1988b (USf); Ueno and Takeda 1992 (A. Γ); Ueno et al. 1986 (Af. B)
subsp. <i>keniaeensis</i> (Kük.) K. Lye, as <i>F. keniaeensis</i> Kük.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>F. consanguinea</i> Kunth	C ₄	Hofstra et al. 1972 (A. Γ)
<i>F. corynocarya</i> F. Muell.	C ₄	Takeda et al. 1985 (Af. $\delta^{13}\text{C}$)
<i>F. cymosa</i> R. Br., as <i>F. cymosa</i> subsp. <i>spathacea</i> (Roth) T. Koyama ^a , as <i>F. spathacea</i> Roth ^b	C ₄	Hofstra et al. 1972 (A. Γ); Prakash et al. 1976 (A) ^b ; Meinzer 1978 (A) ^b ; Hnatiuk 1980 (A); Hesla et al. 1982 ($\delta^{13}\text{C}$); Kuoh and Chiang 1984 (A); Takeda et al. 1985 (Af); Ueno and Takeda 1992 (A) ^a
<i>F. densa</i> S. T. Blake	C ₄	Takeda et al. 1985 (Af. $\delta^{13}\text{C}$)
<i>F. denudata</i> R. Br.	C ₄	Takeda et al. 1985 (Af. $\delta^{13}\text{C}$); Bruhl et al. 1987 (Af. B)
<i>F. depauperata</i> R. Br.	C ₄	Takeda et al. 1985 (Af)
<i>F. dichotoma</i> (L.) Vahl	C ₄	Hattersley et al. 1977 (Af. B [IL]); Gilliland and Gordon-Gray 1978 (USf); Hesla et al. 1982 ($\delta^{13}\text{C}$); Kuoh and Chiang 1984 (A); Takeda et al. 1985 (Af); Ueno et al. 1986 (Af. B); Bruhl et al. 1987 (Af. B); Ueno et al. 1988b (USf); Ueno and Takeda 1992 (A. Γ); Ueno 1998a (US); LR ($\delta^{13}\text{C}$: -10.5, Bon 2186)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>F. diphyloides</i> Makino	C ₄	Ueno et al. 1986 (Af. B); Ueno and Takeda 1992 (A. Γ)
<i>F. dipsacea</i> (Rottb.) C. B. Clarke subsp. <i>verrucifera</i> (Maxim.) T. Koyama	C ₄	Ueno et al. 1986 (Af. B); Ueno and Takeda 1992 (A)
<i>F. ferruginea</i> (L.) Vahl	C ₄	Hofstra et al. 1972 (A. Γ); Hnatiuk 1980 (A); Hesla et al. 1982 (δ ¹³ C); Takeda et al. 1985 (Af. δ ¹³ C); LR (δ ¹³ C: -11.6, <i>Jacques-Félix 7218</i>)
<i>F. fimbristylloides</i> (F. Muell.) Druce	C ₄	Ueno and Takeda 1992 (A)
<i>F. furva</i> R. Br. ^a , as <i>F. capitata</i> R. Br. ^b	C ₄	Takeda et al. 1985 (Af. δ ¹³ C) ^{a,b}
<i>F. hirsutifolia</i> Govindarajalu	C ₄	Govindarajalu 1990a ([A])
<i>F. kadzusana</i> Ohuai	C ₄	Ueno and Takeda 1992 (A)
<i>F. leptoclada</i> Benth.	C ₄	Ueno and Takeda 1992 (A)
<i>F. leucocolea</i> Benth.	C ₄	Takeda et al. 1985 (Af. δ ¹³ C)
<i>F. littoralis</i> Gaud.	C ₄	Akita et al. 1969 ([A]); Carolin et al. 1977 (USf); Takeda et al. 1980 (Af. Γ); Takeda et al. 1985 (Af); Ueno et al. 1986 (Af. B)
<i>F. microcarya</i> F. Muell.	C ₄	Takeda et al. 1985 (Af. δ ¹³ C)
<i>F. miliacea</i> (L.) Vahl, as <i>F. quinquangularis</i> Kunth ^a	C ₄	Hofstra et al. 1972 (A. Γ); Meinzer 1978 (A); Hesla et al. 1982 (δ ¹³ C) ^a ; Kuoh and Chiang 1984 (A); Lin et al. 1993 (Af)
<i>F. nelmesii</i> Kern (<i>Tylocarya cylindrostachya</i> Nelmes)	C ₄	JB (Af: <i>Kerr 21294</i> BM, L)
<i>F. nuda</i> Boeck.	C ₄	Takeda et al. 1985 (Af)
<i>F. nutans</i> (Retz.) Vahl	C ₄	Takeda et al. 1985 (Af); Ueno and Takeda 1992 (A)
<i>F. obtusifolia</i> (Lam.) Kunth	C ₄	LR (δ ¹³ C: -13.0, <i>Chevalier 20054</i>)
<i>F. oligocephala</i> W. V. Fitzg.	C ₄	Takeda et al. 1985 (Af)
<i>F. pallida</i> S. T. Blake	C ₄	Takeda et al. 1985 (Af)
<i>F. pauciflora</i> R. Br.	C ₄	Takeda et al. 1985 (Af); Ueno and Takeda 1992 (A)
<i>F. phaeoleuca</i> S. T. Blake	C ₄	Takeda et al. 1985 (Af. δ ¹³ C)
<i>F. pierotii</i> Miq.	C ₄	Ueno and Takeda 1992 (A. Γ)
<i>F. pilosa</i> Vahl	C ₄	LR (δ ¹³ C: -12.1, <i>Pobéguin 419</i>)
<i>F. polytrichoides</i> (Retz.) R. Br.	C ₄	Hesla et al. 1982 (δ ¹³ C); Kuoh and Chiang 1984 (A); Takeda et al. 1985 (Af. δ ¹³ C); Bruhl et al. 1987 (Af. B); JB (Af: <i>Bruhl 204, 443</i> CANB. δ ¹³ C: -11.1, -11.6, -11.7, <i>Bruhl 443</i>); LR (δ ¹³ C: -15.3, <i>Sacleux 1652</i>)
<i>F. pseudomicrocarya</i> Govindarajalu	C ₄	Govindarajalu 1990a ([A])
<i>F. pterygosperma</i> R. Br.	C ₄	Takeda et al. 1985 (Af)
<i>F. punctata</i> R. Br.	C ₄	Takeda et al. 1985 (Af. δ ¹³ C)
<i>F. rara</i> R. Br.	C ₄	Takeda et al. 1985 (Af. δ ¹³ C)
<i>F. recta</i> F. M. Bailey	C ₄	Takeda et al. 1985 (Af. δ ¹³ C)
<i>F. scabrada</i> Schum. & Thonn.	C ₄	LR (δ ¹³ C: -13.2, <i>Chevalier 23501</i>)
<i>F. schoenoides</i> (Retz.) Vahl	C ₄	Takeda et al. 1985 (Af. δ ¹³ C); Ehleringer et al. 1987 (δ ¹³ C)
<i>F. schultzi</i> Boeck.	C ₄	Takeda et al. 1985 (Af)
<i>F. sericea</i> R. Br.	C ₄	Ueno and Takeda 1992 (A. Γ); Ueno et al. 1986 (Af. B); JB (Af: <i>s. coll.</i> CANB 272779)
<i>F. sieboldii</i> Miq.	C ₄	Kuoh and Chiang 1984 (A); Ueno et al. 1986 (Af. B); Ueno and Takeda 1992 (A. Γ)
<i>F. solidifolia</i> F. Muell.	C ₄	Takeda et al. 1985 (Af)
<i>F. sp.</i> (Carolin 8690)	C ₄	Carolin et al. 1977 (USf)
<i>F. sphaerocephala</i> Benth.	C ₄	Takeda et al. 1985 (Af)
<i>F. splendida</i> C. B. Clarke	C ₄	LR (δ ¹³ C: -11.6, <i>Sita 495</i>)
<i>F. squarrosa</i> Vahl, as <i>F. aestivalis</i> (Retz.) Vahl subsp. <i>squarrosa</i> (Vahl) T. Koyama ^a	C ₄	Takeda et al. 1985 (Af); Ueno et al. 1986 (Af. B) ^a ; Ueno et al. 1988b (USf) ^a ; Ueno and Takeda 1992 (A) ^a
<i>F. stauntonii</i> Debeaux & Franch. subsp. <i>tonensis</i> (Makino) T. Koyama	C ₄	Ueno and Takeda 1992 (A)
<i>F. subbispicata</i> Nees & Meyen ex Nees, as <i>F. tristachya</i> subsp. <i>subbispicata</i> (Nees & Meyen) T. Koyama ^a	C ₄	Kuoh and Chiang 1984 (A); Ueno et al. 1986 (Af. B) ^a ; Ueno et al. 1988b (USf) ^a ; Ueno and Takeda 1992 (A. Γ) ^a
<i>F. tenera</i> Schult.	C ₄	Sabnis 1921 ([A])
<i>F. tetragona</i> R. Br.	C ₄	Carolin et al. 1977 (USf); Takeda et al. 1985 (Af); Bruhl et al. 1987 (Af. B); Bruhl and Perry 1995 (USf)
<i>F. trachycarya</i> F. Muell.	C ₄	Takeda et al. 1985 (Af)
<i>F. trigastrocarya</i> F. Muell.	C ₄	Takeda et al. 1985 (Af)
<i>F. tristachya</i> R. Br., as <i>F. marianna</i> Gaud. ^a	C ₄	Takeda et al. 1985 (Af); JB (Af: <i>Brown</i> MEL 1543831); LR (δ ¹³ C: -12.1, <i>Poillane 20844</i>) ^a

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>F. uliginosa</i> Hochst. ex Steud.	C ₄	Raghavendra and Das 1976 (A. Γ)
<i>F. umbellaris</i> (Lam.) Vahl, as <i>F. globulosa</i> (Retz.) Kunth ^a	C ₄	Kuoh and Chiang 1984 (A); Ueno and Takeda 1992 (A) ^a
<i>F. variegata</i> Gordon-Gray (<i>Abildgaardia variegata</i> (Gordon-Gray) K. Lye)	C ₃	JB (A: <i>Ward 1108</i> BRI)
<i>F. velata</i> R. Br.	C ₄	Carolin et al. 1977 (USf); Bruhl et al. 1987 (Af. B)
<i>F. xyridis</i> R. Br.	C ₄	Takeda et al. 1985 (Af)
<i>Fuirena ciliaris</i> (L.) Roxb., as <i>F. ciliaris</i> var. <i>ciliaris</i> ^a	C ₃	Govindarajalu 1969a ([A]); Hesla et al. 1982 (δ ¹³ C); Takeda et al. 1985 (A); JB (A: <i>Hartley 13767</i> CANB); SCV (δ ¹³ C: -26.63, <i>Rogers 13216</i>) ^a
<i>F. glomerata</i> Lam.	C ₃	Takeda et al. 1985 (A. δ ¹³ C)
<i>F. incrassata</i> S. T. Blake	C ₃	Takeda et al. 1985 (A); JB (A: <i>Bruhl 445</i> CANB)
<i>F. leptostachya</i> Oliv.	C ₃	Hesla et al. 1982 (δ ¹³ C)
var. <i>nudiflora</i> C. B. Clarke	C ₃	SCV (δ ¹³ C: -26.81, <i>Swynnerton 16027</i>)
<i>F. obcordata</i> P. L. Forbes	C ₃	SCV (δ ¹³ C: -26.03, <i>Maputaland Expedition 14313</i>)
<i>F. ochreata</i> Kunth, as <i>F. calolepis</i> K. Schum.	C ₃	Hesla et al. 1982 (δ ¹³ C)
<i>F. pachyrrhiza</i> Ridl., as <i>F. pachyrrhiza</i> var. <i>pachyrrhiza</i> ^a	C ₃	Hesla et al. 1982 (δ ¹³ C); SCV (δ ¹³ C: -25.04, <i>Pegler 309</i>) ^a
<i>F. pubescens</i> (Poir.) Kunth	C ₃	Hesla et al. 1982 (δ ¹³ C); LR (δ ¹³ C: -26.8, <i>Taton 1068</i>)
var. <i>pergamentea</i> Fisch.	C ₃	Govindarajalu 1969a ([A])
<i>F. simplex</i> Vahl	C ₃	LR (δ ¹³ C: -28.9, <i>Stanley 20533</i> , -34.3, Serre Orsay cult., 1972)
<i>F. squarrosa</i> Michx.	C ₃	JB (A: <i>Radford 15859</i> MEL)
<i>F. stricta</i> Steud.	C ₃	Hesla et al. 1982 (δ ¹³ C); Ellery et al. 1992 (δ ¹³ C); SCV (δ ¹³ C: -25.86, <i>Eyles 3850</i>)
<i>F. umbellata</i> Rottb.	C ₃	Govindarajalu 1969a ([A]); Hesla et al. 1982 (δ ¹³ C); Takeda et al. 1985 (A); Bruhl et al. 1987 (A. B); JB (A: <i>Bruhl 214</i> CANB; <i>Dharmawardhana 15</i> CANB. Γ: 43, <i>Bruhl 214</i>); SCV (δ ¹³ C: -25.07, <i>Rogers 13277</i>)
<i>F. uncinata</i> Kunth	C ₃	Govindarajalu 1969a ([A])
<i>F. wallichiana</i> Kunth	C ₃	Govindarajalu 1969a ([A])
<i>F. zambesiaca</i> K. Lye	C ₃	Hesla et al. 1982 (δ ¹³ C)
<i>Gahnia aspera</i> (R. Br.) Spreng.	C ₃	Takeda et al. 1985 (A)
<i>G. baniensis</i> Benl	C ₃	LR (δ ¹³ C: -28.3, <i>Poilane 29003</i>)
<i>G. clarkei</i> Benl	C ₃	Takeda et al. 1985 (A. δ ¹³ C); KW (A: <i>Wilson 7652</i>)
<i>G. deusta</i> (R. Br.) Benth., as “ <i>G. densta</i> ” [sic]	C ₃	Takeda et al. 1985 (A)
<i>G. erythrocarpa</i> R. Br.	C ₃	KW (A: <i>Wilson 7653</i>)
<i>G. howeana</i> R. O. Gardner	C ₃	KW (A: <i>Brown 2003/46</i>)
<i>G. javanica</i> Zoll. & Mor. ex Mor.	C ₃	Hofstra et al. 1972 (A. Γ)
<i>G. lacera</i> (A. Rich.) Steud.	C ₃	Troughton et al. 1974 (δ ¹³ C)
<i>G. lanigera</i> (R. Br.) Benth.	C ₃	Takeda et al. 1985 (A)
<i>G. melanocarpa</i> R. Br.	C ₃	Takeda et al. 1985 (A. δ ¹³ C)
<i>G. procera</i> J. R. Forst. & G. Forst.	C ₃	Betts 1920 ([A])
<i>G. radula</i> (R. Br.) Benth.	C ₃	Takeda et al. 1985 (A)
<i>G. sieberiana</i> Kunth	C ₃	Takeda et al. 1985 (A); KW (A: <i>Wilson 7651</i>)
<i>G. subaequiglumis</i> S. T. Blake	C ₃	Takeda et al. 1985 (A); JB (A: <i>Prober 161</i> CANB)
<i>G. trifida</i> Labill.	C ₃	Takeda et al. 1985 (A. δ ¹³ C)
<i>Gymnoschoenus anceps</i> (R. Br.) Nees	C ₃	KW (A: <i>Jackson NSW 22510</i>)
<i>G. sphaerocephalus</i> (R. Br.) Hook. f.	C ₃	Takeda et al. 1985 (A. δ ¹³ C); JB (A: <i>Bruhl 635</i> CANB); KW (A: <i>Coveny 6302, 6322</i>)
<i>Hellmuthia membranacea</i> (Thunb.) Haines & K. Lye	C ₃	JB (A: <i>Arnold 705</i> PRE; <i>van Jaarsveld 4491</i> PRE)
<i>Hypolytrum bullatum</i> C. B. Clarke	C ₃	Alves et al. 2002 ([A])
<i>H. compactum</i> Nees & Mey. ex Kunth	C ₃	JB (A: <i>van Royen 3212</i> CANB)
<i>H. glaziovii</i> Boeck.	C ₃	Alves et al. 2002 ([A])
<i>H. heteromorphum</i> Nelmes	C ₃	LR (δ ¹³ C: -29.5, Serre Orsay cult., 1972, -36.3, <i>Lorougnon 1272</i>)
<i>H. jenmanii</i> C. B. Clarke	C ₃	Koyama 1967 ([A])
<i>H. lancifolium</i> C. B. Clarke	C ₃	LR (δ ¹³ C: -36.0, <i>Le Testu 9334</i>)
<i>H. longifolium</i> (Rich.) Nees	C ₃	Alves et al. 2002 ([A])
subsp. <i>rubescens</i> (C. B. Clarke) T. Koyama, as <i>H. sylvaticum</i> Poepp. & Kunth subsp. <i>rubescens</i> (C. B. Clarke) T. Koyama	C ₃	Koyama 1967 ([A])

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>H. nemorum</i> (Vahl) Spreng.	C ₃	Hofstra et al. 1972 (A. $\delta^{13}\text{C}$); Takeda et al. 1985 (A. $\delta^{13}\text{C}$); Ehleringer et al. 1987 ($\delta^{13}\text{C}$); JB (A: <i>Bruhl 478</i> CANB); KW (A: <i>Farina s. n.</i> , Queensland NE)
<i>H. nudum</i> C. B. Clarke	C ₃	Koyama 1967 ([A])
<i>H. pulchrum</i> (Rudge) H. Pfeiff.	C ₃	Koyama 1967 ([A]); Alves et al. 2002 ([A]); LR ($\delta^{13}\text{C}$: -31.7, <i>Sagot 889</i>)
<i>H. rigens</i> Nees	C ₃	Alves et al. 2002 ([A])
<i>H. schraderianum</i> Nees	C ₃	Alves et al. 2002 ([A])
<i>H. sp. nov.</i> (Alves et al. 1915)	C ₃	Alves et al. 2002 ([A])
<i>H. sphaerostachyum</i> Boeck.	C ₃	Alves et al. 2002 ([A])
<i>H. stemonifolium</i> T. Koyama	C ₃	Alves et al. 2002 ([A])
<i>H. strictum</i> Poepp. ex Kunth	C ₃	Koyama 1967 ([A])
<i>H. verticillatum</i> T. Koyama	C ₃	Alves et al. 2002 ([A])
<i>Isolepis cernua</i> (Vahl) Roem. & Schult., as <i>Scirpus cernuus</i> Vahl ^a	C ₃	Troughton et al. 1974 ($\delta^{13}\text{C}$); Takeda et al. 1985 (A. $\delta^{13}\text{C}$) ^a ; LR ($\delta^{13}\text{C}$: -27.3, <i>Dieterlen 705</i>)
<i>I. costata</i> Hochst. ex A. Rich., as <i>Scirpus constatus</i> ^a [sic]	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; LR ($\delta^{13}\text{C}$: -29.6, <i>Peter 41441</i>)
<i>I. crassiuscula</i> Hook. f. (<i>Eleogiton crassiusculus</i> (Hook. f.) Benth.)	C ₃	JB (A: <i>van Royen 10857</i> CANB)
<i>I. fluitans</i> (L.) R. Br., as <i>Eleogiton fluitans</i> (L.) Link ^a , as <i>Scirpus fluitans</i> L. ^b	C ₃	Govindarajalu 1976 ([A]) ^b ; Hesla et al. 1982 (A. $\delta^{13}\text{C}$) ^b ; Takeda et al. 1985 (A) ^b ; JB (A: <i>Evans 2778</i> CANB; <i>Telford 10203</i> CANB; <i>van Royen 11001</i> CANB); LR ($\delta^{13}\text{C}$: -29.7, <i>Pappi 749</i>) ^a ; SCV ($\delta^{13}\text{C}$: -25.71, <i>Dummer 1620</i>)
<i>I. graminoides</i> (R. Haines & K. Lye) K. Lye, as <i>Scirpus graminoides</i> R. Haines & K. Lye	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>I. habra</i> (Edgar) Soják	C ₃	JB (A: <i>Bruhl ex-147</i> CANB)
<i>I. hystrix</i> (Thunb.) Nees	C ₃	LR ($\delta^{13}\text{C}$: -24.1, <i>Drège 1601b</i>)
<i>I. inundata</i> R. Br., as <i>Scirpus inundatus</i> (R. Br.) Poir.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$)
<i>I. marginata</i> (Thunb.) A. Dietr., as <i>Scirpus antarcticus</i> L.	C ₃	Takeda et al. 1985 (A)
<i>I. platycarpa</i> (S. T. Blake) Soják, as <i>Scirpus platycarpus</i> S. T. Blake	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$)
<i>I. prolifera</i> (Rottb.) R. Br., as <i>Holoschoenus prolifer</i> (Rottb.) ined. ^a	C ₃	JB (A: <i>Bruhl 126</i> CANB. Γ : 46, <i>Bruhl 126</i>); LR ($\delta^{13}\text{C}$: -26.8, <i>Ecklon s. n.</i> , -34.8, Serre Orsay cult., 1972) ^a
<i>I. sepulcralis</i> Steud., as <i>Scirpus chlorostachys</i> Levyns ^a , as <i>Isolepis sp.</i> (Richards 17045) ^b	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; LR ($\delta^{13}\text{C}$: -27.1, <i>Richards 17045</i>) ^b
<i>I. setacea</i> (L.) R. Br., as <i>Scirpus setaceus</i> L. ^a	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; LR ($\delta^{13}\text{C}$: -28.4, <i>Koernicke FGGE 1774</i>)
<i>I. tenuissima</i> (Nees) Kunth	C ₃	SCV ($\delta^{13}\text{C}$: -24.03, <i>Esterhuysen 28973</i>)
<i>Karinia mexicana</i> (Britton) Reznicek & McVaugh	C ₃	JB (A: <i>Kral 27601</i> MO); KW (A: <i>Arsène 8431</i> P)
<i>Khaosokia caricoides</i> Simpson et al.	C ₃	Simpson et al. 2005 ($\delta^{13}\text{C}$); JB (A: <i>Simpson, De Wilde et al. 1886</i> TCD)
<i>Kobresia laxa</i> Nees	C ₃	Sharma and Mehra 1970 ([A])
<i>K. myosuroides</i> (Vill.) Fiori, as <i>K. bellardii</i> (Allioni) Degland ex Loiseleur ^a	C ₃	JB (A: <i>Clokey MEL 1543850</i> ; <i>Clokey MEL 1543852</i> ; <i>Asplund</i> , 8 Aug 1946 MEL); LR ($\delta^{13}\text{C}$: -25.9, <i>Humbert s. n.</i> , 1911, Col Arsine) ^a
<i>K. nitens</i> C. B. Clarke	C ₃	Sharma and Mehra 1970 ([A])
<i>Koyamaea neblinensis</i> W. W. Thomas & G. Davidse	C ₃	JB (A: <i>Stein 1668</i> MO)
<i>Kyllinga alata</i> (Nees) (Cyperus <i>alatus</i> (Nees) F. Muell.)	C ₄	Getliffe Norris 1983 (A)
<i>K. alba</i> Nees (Cyperus <i>cristatus</i> (Kunth) Mattf. & Kük.)	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); Getliffe Norris 1983 (A); KW (Ac: <i>O'Connor 4</i>)
<i>K. auroealata</i> (K. Lye) ined., as <i>Kyllinga alata</i> [auct. non Nees]	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>K. brevifolia</i> Rottb., as <i>Cyperus brevifolius</i> (Rottb.) Hassk. ^a , as <i>C. breviformis</i> [sic] ^b , as <i>K. colorata</i> (L.) Druce ^c	C ₄	Akita et al. 1969 ([A]); Govindarajalu 1969b ([A]) ^a ; Carolin et al. 1977 (USC) ^a ; Gilliland and Gordon-Gray 1978 (USC) ^c ; Getliffe Norris 1983 (A) ^c ; Takeda et al. 1985 (Ac) ^a ; Li 1993 (A) ^b ; Bruhl et al. 1987 (Ac. B); Lin et al. 1993 (Ac); JB (Ac: <i>Bruhl 162</i> , <i>Bruhl 163</i> CANB. $\delta^{13}\text{C}$: -10.4, <i>Bruhl 163</i> , -10.8, <i>Bruhl 162</i>); KW (Ac: <i>Wilson 678</i> , 3302)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
subsp. <i>leiolepis</i> (Franch. & Sav.) T. Koyama	C ₄	Ueno and Takeda 1992 (A. Γ)
<i>K. bulbosa</i> P. Beauv. (<i>Cyperus richardii</i> Steud.), as <i>K. macrocephala</i> A. Rich.	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>K. cartilaginea</i> K. Schum. (<i>Cyperus cartilagineus</i> (K. Schum.) Mattf. & Kük.)	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>K. chrysantha</i> K. Schum. (<i>Cyperus aureos-tramineus</i> Mattf. & Kük.)	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>K. crassipes</i> Boeck. (<i>Cyperus bulbipes</i> Mattf. & Kük.)	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>K. elata</i> Steud.	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>K. elatior</i> Kunth (<i>Cyperus pinguis</i> (C. B. Clarke) Mattf. & Kük.)	C ₄	Gilliland and Gordon-Gray 1978 (USc); Hesla et al. 1982 (A. δ ¹³ C); Getliffe Norris 1983 (A); SCV (δ ¹³ C: -10.31, <i>Medley Wood 3993</i>)
<i>K. erecta</i> C. B. Clarke (<i>Cyperus erectus</i> (K. Schum.) Mattf. & Kük.), as <i>K. colorata</i> [auct.] ^a	C ₄	Hesla et al. 1982 (δ ¹³ C) ^a ; Getliffe Norris 1983 (A); JB (Ac: <i>Gibbs Russell 2869</i> BRI)
<i>K. intermedia</i> R. Br. (<i>Cyperus sphaeroideus</i> L. Johnson & O. Evans)	C ₄	KW (Ac: <i>Wilson 1453</i>)
<i>K. intricata</i> Cherm. (<i>Cyperus brevifolius</i> subsp. <i>intricatus</i> (Cherm.) K. Lye), as <i>K. aurata</i> [sensu Napper non Nees]	C ₄	Hesla et al. 1982 (A. δ ¹³ C)
<i>K. comosipes</i> (Mattf. & Kük.) Napper (<i>Cyperus comosipes</i> Mattf. & Kük.)	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>K. melanosperma</i> Nees subsp. <i>bifolius</i> (Miq.) ined., as <i>Cyperus melanospermus</i> (Nees) Valck. Sur. subsp. <i>bifolius</i> (Miq.) Kern	C ₄	Govindarajalu 1969b ([A])
subsp. <i>melanosperma</i> , as <i>Cyperus melanospermus</i> (Nees) Valck. Sur.	C ₄	Govindarajalu 1969b ([A]); Hesla et al. 1982 (δ ¹³ C); Getliffe Norris 1983 (A)
<i>K. microstyla</i> C. B. Clarke (<i>Cyperus microstylis</i> (C. B. Clarke) Mattf. & Kük.)	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>K. nemoralis</i> (Forst. & Forst. f.) Dandy ex Hutch. & Dalziel, as <i>Cyperus kyllingia</i> Endl. ^a	C ₄	Govindarajalu 1969b ([A]) ^a ; Hofstra et al. 1972 (A. Γ); Getliffe Norris 1983 (A); LR (δ ¹³ C: -14.4, <i>Squires 790</i> , -14.6, <i>Serre Orsay</i> cult., 1972); SCV (δ ¹³ C: -9.53, <i>Fourcade 1966</i>)
<i>K. nervosa</i> Steud. (<i>Cyperus oblongus</i> (C. B. Clarke) Kük. subsp. <i>nervosus</i> (Steud.) K. Lye)	C ₄	Hesla et al. 1982 (δ ¹³ C); McNaughton et al. 1983 (A)
<i>K. odorata</i> Vahl, as <i>Cyperus sesquiflorus</i> (Torr.) Mattf. & Kük. ^a , as <i>K. cylindrica</i> Nees ^b , as <i>K. sesquiflora</i> Torr. subsp. <i>cylindrica</i> (Nees) T. Koyama ^c	C ₄	Govindarajalu 1969b ([A]) ^a ; Hesla et al. 1982 (δ ¹³ C); Hesla et al. 1982 (δ ¹³ C) ^b ; Getliffe Norris 1983 (A); Takeda et al. 1985 (Ac) ^a ; Ueno and Takeda 1992 (A) ^c ; KW (Ac: <i>Wilson 1557</i>); LR (δ ¹³ C: -13.6, <i>Adam 5802</i>)
<i>K. pauciflora</i> Ridl. (<i>Cyperus ridleyi</i> Mattf. & Kük.)	C ₄	Getliffe Norris 1983 (A)
<i>K. polyphylla</i> Willd. ex Kunth, as <i>Cyperus aromaticus</i> (Ridl.) Mattf. & Kük. ^a	C ₄	Prakash et al. 1976 (A) ^a ; Hesla et al. 1982 (δ ¹³ C); Getliffe Norris 1983 (A); Bruhl et al. 1987 (Ac. B); JB (Ac: <i>Bruhl 512</i> CANB; <i>Dharmawardhana 25</i> CANB. δ ¹³ C: -11.1, -11.2, <i>Bruhl 512</i>); KW (Ac: <i>Parham 9611</i>)
<i>K. pulchella</i> Kunth (<i>Cyperus teneristolon</i> Mattf. & Kük.)	C ₄	Hesla et al. 1982 (δ ¹³ C); Getliffe Norris 1983 (A); KW (Ac: <i>Schlechter 4030</i>); SCV (δ ¹³ C: -9.99, <i>Sister Stephany 27728</i>)
<i>K. pumila</i> Michx., as <i>Cyperus tenuifolius</i> (Steud.) Dandy ^a	C ₄	Hesla et al. 1982 (δ ¹³ C); Li et al. 1999 (A) ^a
<i>K. squamulata</i> Vahl, as <i>Cyperus metzii</i> (Hochst. ex Steud.) Mattf. & Kük.	C ₄	Rikli 1895 ([A]); Govindarajalu 1969b ([A]) ^a
<i>K. tenuifolia</i> Steud., as <i>Cyperus triceps</i> (Rottb.) Endl. ^a , as <i>K. triceps</i> Rottb. ^b	C ₄	Govindarajalu 1969b ([A]) ^a ; Raghavendra and Das 1976 (A. Γ) ^b
<i>K. welwitschii</i> Ridl. (<i>Cyperus welwitschii</i> (Ridl.) K. Lye)	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>Kyllingiella microcephala</i> (Steud.) Haines & K. Lye, as <i>Scirpus microcephalus</i> (Steud.) Dandy ^a , as <i>Isolepis microcephala</i> (Steud.) K. Lye ^b	C ₃	Druyts-Voets 1970 ([A]) ^a ; Hesla et al. 1982 (δ ¹³ C) ^a ; JB (A: <i>Wanntorp 405</i> PRE); LR (δ ¹³ C: -29.3, <i>Adam 12362</i>) ^b

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>K. polyphylla</i> (A. Rich.) K. Lye, as <i>Isolepis polyphylla</i> A. Rich. ^a	C ₃	JB (A: Gillett 12991 EA); LR ($\delta^{13}\text{C}$: -27.3, Pappi 3859) ^a
<i>Lagenocarpus guianensis</i> Nees	C ₃	JB (A: Broadway 759 K)
<i>L. rigidus</i> (Kunth) Nees	C ₃	LR ($\delta^{13}\text{C}$: -27.7, Irwin et al. 13523)
<i>L. verticillatus</i> (Spreng.) T. Koyama & Ma-guire	C ₃	JB (A: Steyermark 89702 BRI)
<i>Lepidosperma aphyllum</i> R. Br.	C ₃	KW (A: Whaite 4323A; Wilson 2853)
<i>L. avium</i> K. L. Wilson	C ₃	KW (A: Forde 905)
<i>L. brunonianum</i> Nees	C ₃	KW (A: Newbey 4676; Tindale 150; Wilson 2796)
<i>L. canescens</i> Boeck.	C ₃	Takeda et al. 1985 (A); KW (A: Beaglehole 37932, Beaglehole 39126)
<i>L. carphoides</i> F. Muell. ex Benth.	C ₃	Takeda et al. 1985 (A); KW (A: Johnson 7924; Streimann 3312; Whibley 3605; Wilson 3060)
<i>L. concavum</i> R. Br.	C ₃	KW (A: Beaglehole 25305; Blake 22763; Blakely NSW 463671; Canning 2543C; Durrington 1222; McKay NSW 150413; Phillips NSW 464140; Wilson 464, 2204, 2241, 2391)
<i>L. congestum</i> R. Br.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); KW (A: Symon 6395; Wilson 1079)
<i>L. costale</i> Nees	C ₃	KW (A: Coveny 7967)
<i>L. curtisiae</i> K. L. Wilson & D. I. Morris	C ₃	KW (A: Boorman NSW 517775; Wilson 1708)
<i>L. drummondii</i> Benth.	C ₃	KW (A: Fitzgerald NSW 19781)
<i>L. effusum</i> Benth.	C ₃	JB (A: Crisp 5231 CBG); KW (A: Crisp 5231 NSW)
<i>L. elatius</i> Labill.	C ₃	KW (A: Wilson 10203)
<i>L. ensiforme</i> (Rodway) D. I. Morris	C ₃	KW (A: Wilson 10200)
<i>L. evansianum</i> K. L. Wilson	C ₃	KW (A: Wilson 8626)
<i>L. filiforme</i> Labill.	C ₃	KW (A: Armstrong 866; Beaglehole 25024; Boyd 1871; Constable 7340, 7352, NSW 53920; Coveny 4901; Evans NSW 136815; Henshall SYD 367116; McGillivray 148)
<i>L. forsythii</i> A. A. Hamilton	C ₃	KW (A: Beaglehole 30224; Coveny 6286, 7374, 10051)
<i>L. gladiatum</i> Labill.	C ₃	Takeda et al. 1985 (A); KW (A: Beard 7735; Cheel NSW 150436; Jones NSW 150435; Pickard 1123; Telford 1859)
<i>L. gracile</i> R. Br.	C ₃	KW (A: Blake 18027; Tindale 3913)
<i>L. gunnii</i> Boeck.	C ₃	KW (A: Adams 1841; Constable 5027; Johnson 7053, 8536; McBarron 12361)
<i>L. inops</i> Rodway ex F. Muell.	C ₃	JB (A: Bruhl 630 CANB); KW (A: Ratkowsky 545)
<i>L. latens</i> K. L. Wilson	C ₃	KW (A: Coveny 598; Evans 2610; Moore 1932; Wilson 8631)
<i>L. laterale</i> R. Br. ^a , as <i>L. lineare</i> R. Br. ^b	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$) ^{ab} ; KW (A: Barry 27; Blake 5312; Blaxell 814; Briggs NSW 466982; Campbell & Pickard 1221; Constable 5503; Evans NSW 128084; Johnson 2132, NSW 20431, 156454; McKee 11566; Milthorpe & Cunningham 5523; Salasoo 3663; Wilson 822, 2319, 3992, 3696, 4419) ^a
<i>L. leptostachyum</i> Benth. var. <i>asperatum</i> Kük.	C ₃	KW (A: Newbey 4678)
<i>L. limicola</i> N. A. Wakefield	C ₃	KW (A: Constable 4356; Coveny 6132, 6310; Gregson NSW 464158; Johnson 622; Wilson 3206)
<i>L. longitudinale</i> Labill.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); KW (A: Briggs 4278; Betche NSW 295546; Johnson NSW 79147; Kenneally 7178; Lucas NSW 150437; Williamson NSW 295762; Wilson 1190, 1601, 2168, 2404)
<i>L. neesii</i> Kunth	C ₃	KW (A: Coveny 4903; McBarron 10516; Opie & van Rees 128; Wilson 4029)
<i>L. obtusum</i> Kük.	C ₃	KW (A: Wilson 8882)
<i>L. oldfieldii</i> Hook. f.	C ₃	KW (A: Rodway NSW 150438)
<i>L. perteres</i> C. B. Clarke	C ₃	LR ($\delta^{13}\text{C}$: -25.7, Raynal & Jaffré 16520)
<i>L. pruinatum</i> Kük. var. <i>rigidulum</i> Kük.	C ₃	KW (A: Newbey 4699; Wilson 2579)
<i>L. pubisquamatum</i> Steud.	C ₃	KW (A: Salasoo 4117; Wilson 2834)
<i>L. quadrangulatum</i> A. A. Hamilton	C ₃	KW (A: Coveny 4893; McGillivray 2298)
<i>L. scabrum</i> Nees	C ₃	KW (A: Wilson 2695)
<i>L. semiteres</i> F. Muell. ex Boeck.	C ₃	Takeda et al. 1985 (A); KW (A: Beaglehole 43906; Blake 16830)
<i>L. sp. A1</i> (Wilson 2578)	C ₃	KW (A)
<i>L. sp. aff. elatius</i> (Fallding NSW 150145)	C ₃	KW (A: Boorman NSW 519847; Fallding NSW 150145; Williams K4)
<i>L. sp. B2</i> (Crisp 4833)	C ₃	KW (A)
<i>L. sp. E3</i> (Whaite 4105)	C ₃	KW (A)
<i>L. sp. E4</i> (Wilson 2703)	C ₃	KW (A)
<i>L. sp. F</i> (Pulley 1481)	C ₃	KW (A: Pulley 1481; Koch 1208)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>L. sp. F1 (Fitzgerald NSW 19769)</i>	C ₃	KW (A)
<i>L. sp. I (Wilson 3015)</i>	C ₃	KW (A)
<i>L. sp. P (Tindale 166A)</i>	C ₃	KW (A)
<i>L. sp. Q (Wilson 2717)</i>	C ₃	KW (A)
<i>L. sp. S2 (Coveny 7871)</i>	C ₃	KW (A)
<i>L. sp. T2 (Wilson 2982)</i>	C ₃	KW (A)
<i>L. sp. U1 (Tindale 3846)</i>	C ₃	KW (A)
<i>L. sp. U3 (Blake 18076)</i>	C ₃	KW (A)
<i>L. sp. Z (Wilson 9102)</i>	C ₃	KW (A)
<i>L. squamatum</i> Labill.	C ₃	KW (A: <i>Whaite 4318</i> ; <i>Wilson 2954</i>)
<i>L. striatum</i> R. Br.	C ₃	KW (A: <i>Wilson 2946</i>)
<i>L. tenue</i> Benth.	C ₃	KW (A: <i>Wilson 2764</i>)
<i>L. tetraquetrum</i> Nees	C ₃	KW (A: <i>Wilson 3022</i>)
<i>L. tortuosum</i> F. Muell.	C ₃	KW (A: <i>Fuhrer & Beauglehole 39756</i> ; <i>Johnson 7062</i> ; <i>Ratkowsky 1606</i> ; <i>Tindale NSW 83944</i>)
<i>L. tuberculatum</i> Nees	C ₃	Takeda et al. 1985 (A); KW (A: <i>Fitzgerald NSW 19796</i> , <i>NSW 19798</i>)
<i>L. urophorum</i> N. A. Wakefield	C ₃	Takeda et al. 1985 (A); KW (A: <i>Beauglehole 32798</i> ; <i>Coveny 959</i> ; <i>Wilson 2277</i> , <i>3119</i>)
<i>L. ustulatum</i> Steud.	C ₃	KW (A: <i>Wilson 2949</i>)
<i>L. viscidum</i> R. Br.	C ₃	Takeda et al. 1985 (A); KW (A: <i>Beauglehole 37332</i> ; <i>Coveny 10067</i> ; <i>Johnson NSW 365502</i> ; <i>Mulham W832</i> ; <i>Wilson 1091</i> , <i>8628</i>)
<i>Lepironia articulata</i> (Retz.) Domin ^a , as <i>L. mucronata</i> Rich. ^b	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$) ^{ab} ; JB (A: <i>Bruhl 526 CANB</i> ; <i>Lazarides 8120 CANB</i>); KW (A: <i>Wilson 10195</i>) ^a ; LR ($\delta^{13}\text{C}$: -28.1 , <i>Poilane 23083</i>) ^a
<i>Lipocarpha albiceps</i> Ridl.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -11.3 , <i>Audru 774</i>)
<i>L. chinensis</i> (Osbn.) Kern	C ₄	Govindarajalu 1974 ([A]); Hesla et al. 1982 ($\delta^{13}\text{C}$); Ueno and Takeda 1992 (A); SCV ($\delta^{13}\text{C}$: -10.30 , <i>Jeague 520</i>)
<i>L. hemisphaerica</i> (Roth) Goetgh., as <i>Hemicarpha isolepis</i> Nees ^a	C ₄	LR ($\delta^{13}\text{C}$: -10.4 , <i>Leprieur s. n.</i> , St Louis, Senegal) ^a ; SCV ($\delta^{13}\text{C}$: -9.45 , <i>Rogers 6024</i>)
<i>L. kernii</i> (Raym.) Goetgh., as <i>Rikliella kernii</i> (Raym.) J. Raynal	C ₄	Raynal 1973 (Ac); LR ($\delta^{13}\text{C}$: -12.7 , <i>Schweinfurth 2572</i>) ^a
<i>L. micrantha</i> (Vahl) G. C. Tucker, as <i>Hemicarpha subsquarrosa</i> (Muhl.) Nees	C ₄	LR ($\delta^{13}\text{C}$: -11.1 , <i>Hall s. n.</i> , 1866)
<i>L. microcephala</i> (R. Br.) Kunth	C ₄	Takeda et al. 1985 (Ac); Ueno et al. 1986 (Ac. B); Bruhl et al. 1987 (Ac. B); Ehleringer et al. 1987 ($\delta^{13}\text{C}$); Ueno and Takeda 1992 (A); JB (Ac: <i>Bruhl 181</i> , <i>287 CANB</i>)
<i>L. nana</i> (A. Rich.) Cherm.	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); SCV ($\delta^{13}\text{C}$: -10.34 , <i>Bolus 6025</i>)
<i>L. occidentalis</i> (A. Gray) G. C. Tucker (<i>Hemicarpha occidentalis</i> A. Gray)	C ₄	JB (Ac: <i>s. coll. MEL 1543861</i>)
<i>L. prieuriana</i> Steud.	C ₄	LR ($\delta^{13}\text{C}$: -11.9 , <i>Fotius 1886</i>)
<i>L. raynaliana</i> Govindarajalu	C ₄	Govindarajalu 1981 ([A])
<i>L. rehmannii</i> (Ridl.) Goetgh., as <i>Rikliella rehmannii</i> (Ridl.) J. Raynal ^a	C ₄	Raynal 1973 (Ac) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; JB (Ac: <i>Taylor 10652 K</i>); LR ($\delta^{13}\text{C}$: -12.3 , <i>Dinter 7560</i>) ^a
<i>L. squarrosa</i> (L.) Goetgh., as <i>Rikliella squarrosa</i> (L.) J. Raynal ^a	C ₃ + C ₄	SCV ($\delta^{13}\text{C}$: -24.57 , <i>Bolus 4529</i>) Sharma 1972 ([A]); Raynal 1973 (Ac); Govindarajalu and Raynal 1976 ([A]); LR ($\delta^{13}\text{C}$: -13.5 , <i>Couderc s. n.</i> , 1920, Cambodia)
<i>Machaerina anceps</i> (Poir.) Boj.	C ₃	LR ($\delta^{13}\text{C}$: -26.4 , <i>Bosser 147</i>)
<i>M. falcata</i> (Nees) T. Koyama	C ₃	JB (A: <i>Sleumer BW14012 CANB</i>)
<i>M. insularis</i> (Benth.) T. Koyama	C ₃	JB (A: <i>Hoogland 8807 CANB</i>); KW (A: <i>Brown 2003/35</i>)
<i>Mapania baldwinii</i> Nelmes	C ₃	LR ($\delta^{13}\text{C}$: -33.5 , <i>Serre Orsay cult.</i> , 1972)
<i>M. bancana</i> (Miq.) Benth. & Hook. f. ex B. D. Jacks., as <i>Thoracostachyum bancanum</i> (Miq.) Kurz ^a	C ₃	Koyama 1967 ([A]) ^a ; JB (A: <i>Jacobs 5647 CANB</i>); LR ($\delta^{13}\text{C}$: -28.0 , <i>Beccari 3332</i>) ^a
<i>M. coriandrimum</i> Nelmes	C ₃	LR ($\delta^{13}\text{C}$: -31.3 , <i>Serre Orsay cult.</i> , 1972, -37.4 , <i>Lorougnon 1260</i>)
<i>M. cuspidata</i> (Miq.) Uittien, as <i>M. humilis</i> auct. non (Steud.) P. Villar	C ₃	Koyama 1967 ([A])
<i>M. cuspidata</i> (Miq.) Uittien var. <i>petiolata</i> (C. B. Clarke) Uittien	C ₃	JB (A: <i>s. coll. MEL 1543834</i>)
<i>M. effusa</i> (C. B. Clarke) T. Koyama, as <i>Mapaniopsis effusa</i> C. B. Clarke	C ₃	Koyama 1967 ([A]); Metcalfe 1971 ([A])
<i>M. macrantha</i> (Boeck.) H. Pfeiff.	C ₃	LR ($\delta^{13}\text{C}$: -33.4 , <i>Serre Orsay cult.</i> , 1972)
<i>M. macrocephala</i> (Gaud.) K. Schum.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$)
<i>M. macrophylla</i> (Boeck.) H. Pfeiff.	C ₃	Koyama 1967 ([A])

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>M. mannii</i> C. B. Clarke	C ₃	LR ($\delta^{13}\text{C}$: -32. ?[illegible], Serre Orsay cult., -36.2, <i>Farron 4099</i>)
<i>M. soyauxii</i> (Boeck.) H. Pfeiff.	C ₃	LR ($\delta^{13}\text{C}$: -35.6, <i>Hallé & Villiers 5429</i> , -35.8, Serre Orsay cult., 1972)
<i>M. sumatrana</i> (Miq.) Benth., as <i>Thoracostachyum sumatranum</i> (Miq.) Kurz ^a	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$) ^a ; JB (A: <i>Bruhl 308 CANB</i>)
<i>M. sylvatica</i> Aubl.	C ₃	Koyama 1967 ([A]); LR ($\delta^{13}\text{C}$: -35.4, <i>Mangenot 3</i>)
<i>Mesomelaena graciliceps</i> (C. B. Clarke) K. L. Wilson	C ₃	KW (A: <i>Newbey 4976</i> ; <i>Wilson 2888, 2924, 2957</i>)
<i>M. preissii</i> Nees, as <i>M. stygia</i> ^a [voucher <i>Coveny 8296</i> re-determined by KLW in NSW]	C ₃	Takeda et al. 1985 (A) ^a ; KW (A: <i>Canning WA/68 2493</i> ; <i>Koch 1729</i> ; <i>Wilson 2606, 2771, 2782</i>)
<i>M. pseudostygia</i> (Kük.) K. L. Wilson	C ₃	KW (A: <i>Blake 18149</i> ; <i>Coveny 3119</i> ; <i>Wilson 2632</i>)
<i>M. stygia</i> (R. Br.) Nees subsp. <i>deflexa</i> (Kük.) K. L. Wilson	C ₃	KW (A: <i>Hnatiuk 8000012</i> ; <i>Mueller s. n. B</i>)
<i>M. stygia</i> subsp. <i>stygia</i>	C ₃	KW (A: <i>Tindale 3849</i> ; <i>Weston 8209</i> ; <i>Wilson 2897, 2907, 2919, 2993</i>)
<i>M. tetragona</i> (R. Br.) Benth.	C ₃	Takeda et al. 1985 (A); JB (A: <i>Bailey CANB 63655</i>); KW (A: <i>Tindale 284</i> ; <i>Wilson 2918</i>); LR ($\delta^{13}\text{C}$: -25.0, <i>Home s. n.</i> , Australia)
<i>Microdracoides squamosus</i> Hua	C ₃	Chermezon 1933 ([A]); JB (A: <i>Morton K685 K. \delta^{13}\text{C}: -26.6, -27.1, <i>Morton K685</i>); LR ($\delta^{13}\text{C}$: -28.4, <i>Leeuwenberg 5451</i>, -33.7, Serre Orsay cult., 1972)</i>
<i>Morelotia affinis</i> (Brongn.) S. T. Blake	C ₃	JB (A: <i>Bagnall 56270 NSW</i>)
<i>M. gahniiiformis</i> Gaud.	C ₃	JB (A: <i>Henrickson 3490</i> ; <i>Ordoney, 14 Jul 1940 CANB</i>)
<i>Neesenbeckia punctoria</i> (Vahl) Levyns	C ₃	JB (A: <i>Orchard 36 K</i> ; <i>Taylor 3266 PRE</i>); LR ($\delta^{13}\text{C}$: -29.0, <i>McOwan 1688</i>); SCV ($\delta^{13}\text{C}$: -26.01, <i>Levyns 8328</i>)
<i>Nelmesia melanostachya</i> Van der Veken, as <i>Nelmesia</i> ^a	C ₄	Lerman and Raynal 1972 (A) ^a ; LR ($\delta^{13}\text{C}$: -12.8, <i>Gérard 57</i>)
<i>Nemum spadiceum</i> (Lam.) Desv. ex Hamilton, as <i>N. angolensis</i> (C. B. Clarke) J. Raynal ined.	C ₄	LR ($\delta^{13}\text{C}$: -11.6, <i>Le Testu 3384</i>)
<i>N. equitans</i> (Kük.) J. Raynal	C ₄	Raynal 1973 (Af); LR ($\delta^{13}\text{C}$: -13.2, <i>Robinson 3912</i>)
<i>Oreobolopsis inversa</i> Dhooge & Goetgh.	C ₃	Dhooge and Goetghebeur 2002 ([A])
<i>O. tepalifera</i> T. Koyama & Guaglianone	C ₃	Koyama and Guaglianone 1987 ([A])
<i>Oreobolus acutifolius</i> S. T. Blake	C ₃	JB (A: <i>Bruhl 626 CANB</i>)
<i>O. ambiguus</i> Kük. & Steenis	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: <i>Hope ANU 16067 CANB</i>)
<i>O. distichus</i> F. Muell.	C ₃	Takeda et al. 1985 (A); JB (A: <i>Gray 4834 CANB</i>)
<i>O. kuekenthalii</i> Steenis	C ₃	JB (A: <i>Nooteboom 2023 CANB</i>)
<i>O. obtusangulus</i> Gaud.	C ₃	LR ($\delta^{13}\text{C}$: -24.1, <i>Holm & Iltis 571</i>)
<i>O. oligocephalus</i> W. M. Curtis (<i>Schoenoides oligocephalus</i> (W. M. Curtis) O. Seberg)	C ₃	JB (A: <i>Bruhl 626 CANB</i>)
<i>O. oxycarpus</i> S. T. Blake	C ₃	Takeda et al. 1985 (A)
<i>O. pumilio</i> R. Br. subsp. <i>pumilio</i> , as <i>O. pumilio</i> ^a	C ₃	Takeda et al. 1985 (A) ^a ; JB (A: <i>Telford 3686 CBG</i>)
<i>Oxycaryum cubense</i> (Poepp. & Kunth) K. Lye	C ₃	JB (A: <i>Smith 611 PRE</i> ; <i>Ward 8044 PRE</i>); KW (A: <i>Krapovickas 24620 P</i>); LR ($\delta^{13}\text{C}$: -27.6, <i>Trochain 2135</i>)
<i>Paramapania parvibractea</i> (C. B. Clarke) Uittien	C ₃	Takeda et al. 1985 (A)
<i>P. radians</i> (C. B. Clarke) Uittien	C ₃	JB (A: <i>Jacobs 5597 CANB</i> ; <i>Ramos, Aug 1915 BRI 002215. \delta^{13}\text{C}: -29.2, <i>Ramos, Aug 1915</i>); LR ($\delta^{13}\text{C}$: -30.4, <i>Ramos 23642</i>)</i>
<i>P. simplex</i> (Ridl.) Uittien	C ₃	JB (A: <i>Brass 13481 BRI. \delta^{13}\text{C}: -31.7, <i>Brass 13481</i>)</i>
<i>Phylloscirpus acaulis</i> (Philippi) Goetgh. & D. A. Simpson, as <i>Scirpus acaulis</i> Philippi ^a	C ₃	Ponessa et al. 1997 ([A]); BDW (A: <i>Laegaard S-54783 AAU</i>)
<i>P. boliviensis</i> (Barros) Dhooge & Goetgh.	C ₃	BDW (A: <i>Beck 22360 GENT</i>)
<i>P. deserticola</i> (Philippi) Dhooge & Goetgh.	C ₃	BDW (A: <i>Laegaard S-54816 AAU</i>)
<i>Pleurostachys gaudichaudii</i> Brongn.	C ₃	LR ($\delta^{13}\text{C}$: -30.2, <i>Riedel s. n.</i> , 1823)
<i>Principina grandis</i> Uittien	C ₃	JB (A: <i>Exell 703 BM</i>)
<i>Pseudoschoenus inanus</i> (Thunb.) Oteng-Yeboah	C ₃	JB (A: <i>Muller 619 K</i>)
<i>Ptilothrix deusta</i> (R. Br.) K. L. Wilson, as <i>Ptilanthelium deustum</i> (R. Br.) Kük. ^a	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$) ^a ; JB (A: <i>Bruhl 71 CANB</i> ; <i>Prober 356 CANB</i>); KW (A: <i>Coveny 6687</i>)
<i>Pycneus aethiops</i> (Ridl.) C. B. Clarke (<i>Cyperus aethiops</i> Ridl.)	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>P. atroglumosus</i> (Govindarajalu) P. Singh & V. Singh, as <i>Cyperus atroglumosus</i> Govindarajalu	C ₄	Govindarajalu 1978 ([A])
<i>P. bipartitus</i> (Torr.) C. B. Clarke, as <i>Cyperus bipartitus</i> Torr.	C ₄	Li et al. 1999 (A. δ ¹³ C)
<i>P. compressiformis</i> Cherm. (<i>Cyperus compressiformis</i> (Cherm.) Kük.)	C ₄	KW (Ac: <i>Leandri 1029 P</i>)
<i>P. diandrus</i> (Torr.) C. B. Clarke, as <i>Cyperus diandrus</i> Torr.	C ₄	Li et al. 1999 (A. δ ¹³ C)
<i>P. divulsus</i> (Ridl.) C. B. Clarke (<i>C. divulsus</i> Ridl.)	C ₄	KW (Ac: <i>Bosser 15364 PRE</i>)
<i>P. fibrillosus</i> (Kük.) Cherm. (<i>P. scaettae</i> Cherm., <i>Cyperus fibrillosus</i> Kük.)	C ₄	LR (δ ¹³ C: -12.2, <i>Le Testu 7452</i>)
<i>P. filicinus</i> (Vahl) T. Koyama, as <i>Cyperus filicinus</i> Vahl	C ₄	Li et al. 1999 (A. δ ¹³ C)
<i>P. flavescens</i> (L.) Beauv. ex Rchb., as <i>Cyperus flavescens</i> L. ^a	C ₄	Meinzer 1978 (A) ^a ; Hesla et al. 1982 (δ ¹³ C); Kalapos et al. 1997 (δ ¹³ C); Li et al. 1999 (A. δ ¹³ C) ^a ; LR (δ ¹³ C: -11.9, <i>Chevalier 908</i>); SCV (δ ¹³ C: -10.93, <i>Pegler 1089</i>)
<i>P. flavescens</i> (L.) Rchb., as <i>Cyperus flavescens</i> L. ^a	C ₃ +	Li 1993 (A. δ ¹³ C)
<i>P. flavicomus</i> (Michx.) C. D. Adams, as <i>Cyperus albomarginatus</i> (Mart. & Schrad. ex Nees) Steud. ^a , as <i>C. flavicomus</i> Michx. ^b	C ₄	Downton and Tregunna 1968 (Γ) ^a ; Tregunna et al. 1970 (Ac. B. Γ. δ ¹³ C) ^a ; Meinzer 1978 (A) ^a ; Li et al. 1999 (A) ^b
<i>P. flavidus</i> (Retz.) T. Koyama, as <i>Cyperus flavidus</i> Retz. ^a , as <i>P. globosus</i> (All.) Rchb. ^b	C ₄	Hofstra et al. 1972 (A. Γ) ^b ; Govindarajalu 1978 ([A]) ^a ; Saxena and Ramakrishnan 1984 (A) ^b ; Takeda et al. 1985 (A. δ ¹³ C); Ueno et al. 1986 (Ac. B) ^b ; Ueno et al. 1988b (USC) ^b ; Ueno and Takeda 1992 (A. Γ); Li 1993 (δ ¹³ C) ^a ; JB (Ac: <i>Lazarides 7350 CANB</i>)
<i>P. flavidus</i> (Retz.) T. Koyama, as <i>Cyperus flavidus</i> Retz. ^a , as <i>P. globosus</i> (All.) Rchb. ^b	C ₃ +	Saxena and Ramakrishnan 1984 (A)
<i>P. govindarajalui</i> V. S. Raju., as <i>Cyperus decumbens</i> Govindarajalu (non <i>P. decumbens</i> T. Koyama)	C ₄	Govindarajalu 1978 ([A])
<i>P. hildebrandtii</i> C. B. Clarke (<i>Cyperus pseudohildebrandtii</i> Kük.)	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>P. intactus</i> (Vahl) J. Raynal (<i>Cyperus intactus</i> Vahl), as <i>P. ferrugineus</i> (Poir.) C. B. Clarke	C ₄	Gilliland and Gordon-Gray 1978 (USC)
<i>P. intermedius</i> (Steud.) C. B. Clarke (<i>Cyperus subintermedius</i> Kük.)	C ₄	KW (Ac: <i>Audru 6062 P</i>)
<i>P. lanceolatus</i> (Poir.) C. B. Clarke, as <i>Cyperus lanceolatus</i> Poir.	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>P. latespicatus</i> (Boeck.) C. B. Clarke, as <i>Cyperus latespicatus</i> Boeck.	C ₄	Govindarajalu 1978 ([A])
<i>P. latevaginatus</i> (Govindarajalu) P. & V. Singh, as <i>Cyperus latevaginatus</i> Govindarajalu	C ₄	Govindarajalu 1978 ([A])
<i>P. longistolon</i> (A. Peter & Kük.) Napper (<i>Cyperus longistolon</i> A. Peter & Kük.)	C ₄	Hesla et al. 1982 (δ ¹³ C)
<i>P. luridus</i> (Govindarajalu) P. Singh & V. Singh, as <i>Cyperus luridus</i> Govindarajalu	C ₄	Govindarajalu 1978 ([A])
<i>P. macranthus</i> (Boeck.) C. B. Clarke (<i>Cyperus macranthus</i> Boeck.)	C ₄	Hesla et al. 1982 (δ ¹³ C); KW (Ac: <i>Rudatis 702</i>)
<i>P. macrostachyos</i> (Lam.) J. Raynal, as <i>Cyperus albomarginatus</i> (Mart. & Schrad. ex Nees) Steud. ^a , as <i>C. macrostachyos</i> Lam. ^b	C ₄	Carolin et al. 1977 (USC) ^b ; Govindarajalu 1978 ([A]) ^b ; Hesla et al. 1982 (δ ¹³ C); Takeda et al. 1985 (Ac. δ ¹³ C) ^a ; KW (Ac: <i>Decary 16455 P</i>) ^b
<i>P. mundii</i> Nees, as <i>Cyperus mundtii</i> [sic] (Nees) Kunth ^a	C ₄	Hesla et al. 1982 (δ ¹³ C); Li 1993 (A. Γ) ^a ; LR (δ ¹³ C: -12.0, <i>Gaston 688</i>)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>P. nervulosus</i> (Kük.) ined., as <i>Cyperus nervulosus</i> (Kük.) S. T. Blake	C ₄	Carolin et al. 1977 (USc)
<i>P. niger</i> (Ruiz & Pav.) Cufod., as <i>Chlorocyperus cimicinus</i> (J. Presl & C. Presl) Rikli	C ₄	Rikli 1895 ([A])
<i>P. niger</i> (Ruiz & Pav.) Cufod. subsp. <i>elegantulus</i> (Steud.) K. Lye (<i>Cyperus niger</i> Ruiz & Pav. subsp. <i>elegantulus</i> (Steud.) K. Lye), as <i>P. elegantulus</i> (Steud.) C. B. Clarke ^a	C ₄	Lerman and Raynal 1972 (A) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; LR ($\delta^{13}\text{C}$: -12.2, <i>Schimper 118</i>) ^a
<i>P. nigricans</i> (Steud.) C. B. Clarke (<i>Cyperus nigricans</i> Steud.)	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); KW (Ac: <i>Lye 5288 P</i>)
<i>P. nitidus</i> (Lam.) J. Raynal (<i>Cyperus nitidus</i> Lam.)	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); Ellery et al. 1992 ($\delta^{13}\text{C}$); SCV ($\delta^{13}\text{C}$: -10.02, <i>Tyson 168I</i>)
<i>P. pelophilus</i> (Ridl.) C. B. Clarke (<i>Cyperus pelophilus</i> Ridl.)	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$); SCV ($\delta^{13}\text{C}$: -10.93, <i>Russell 2076</i>)
<i>P. permutatus</i> (Boeck.) Napper (<i>Cyperus permutatus</i> Boeck.)	C ₄	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>P. pervillei</i> (Boeck.) C. B. Clarke (<i>Cyperus pervillei</i> Boeck.)	C ₄	KW (Ac: <i>Humbert 4045 P</i>)
<i>P. plumbeonuceus</i> (Govindarajalu) P. Singh & V. Singh, as <i>Cyperus plumbeonuceus</i> Govindarajalu	C ₄	Govindarajalu 1978 ([A])
<i>P. plurinodosus</i> (Govindarajalu) P. Singh & V. Singh, as <i>Cyperus plurinodosus</i> Govindarajalu	C ₄	Govindarajalu 1978 ([A])
<i>P. polystachyos</i> (Rottb.) Beauv., as <i>Cyperus polystachyos</i> Rottb. ^a	C ₄	Carolin et al. 1977 (USc) ^a ; Govindarajalu 1978 ([A]) ^a ; Takeda et al. 1985 (Ac) ^a ; Bruhl et al. 1987 (Ac. B); Hesla et al. 1982 ($\delta^{13}\text{C}$); Ueno et al. 1986 (Ac); Ueno and Takeda 1992 (A. Γ); Li 1993 (A. $\delta^{13}\text{C}$) ^a ; Lin et al. 1993 (Ac); Bruhl and Perry 1995 (USc); Li et al. 1999 (A. $\delta^{13}\text{C}$) ^a ; Soros and Dengler 2001 (Ac); JB (Ac: <i>Bruhl 190 CANB</i>); KW (Ac: <i>Wilson 1447</i>)
var. <i>laxiflorus</i> Benth.	C ₄	SCV ($\delta^{13}\text{C}$: -10.43, <i>McOwan 1326</i>)
<i>P. pumilus</i> (L.) Nees, as <i>Cyperus pumilus</i> L. ^a	C ₄	Govindarajalu 1978 ([A]) ^a ; Hnatiuk 1980 (A); Hesla et al. 1982 ($\delta^{13}\text{C}$); LR ($\delta^{13}\text{C}$: -11.3, <i>Chevalier 9857</i>)
<i>P. punctulatus</i> (Vahl) Nees, as <i>Cyperus punctulatus</i> Vahl	C ₄	Govindarajalu 1978 ([A])
<i>P. sanguinolentus</i> (Vahl) Nees, as <i>Cyperus sanguinolentus</i> Vahl ^a , as <i>C. sanguinolentus</i> [sic] ^b , as <i>Cyperus sanguinolentus</i> subsp. <i>sanguinolentus</i> ^c	C ₄	Hattersley et al. 1977 (Ac. B [IL]) ^a ; Govindarajalu 1978 ([A]) ^c ; Hesla et al. 1982 ($\delta^{13}\text{C}$); Ueno et al. 1986 (Ac); Ueno et al. 1988b (USc); Ueno and Takeda 1992 (A. Γ); Li and Jones 1994 (A) ^b ; KW (Ac: <i>Wilson 1444</i>)
subsp. <i>cyrtostachys</i> (Miq.) S. Karthikeyan, as <i>Cyperus sanguinolentus</i> subsp. <i>cyrtostachys</i> (Miq.) Kern	C ₄	Govindarajalu 1978 ([A])
var. <i>micronux</i> (C. B. Clarke) S. Karthikeyan, as <i>Cyperus sanguinolentus</i> var. <i>micronux</i> (C. B. Clarke) Kük.	C ₄	Govindarajalu 1978 ([A])
<i>P. stramineus</i> (Nees) C. B. Clarke, as <i>Cyperus substramineus</i> Kük.	C ₄	Govindarajalu 1978 ([A])
<i>P. stricticulmis</i> (Govindarajalu) P. Singh & V. Singh, as <i>Cyperus stricticulmis</i> Govindarajalu	C ₄	Govindarajalu 1978 ([A])
<i>P. sulcinux</i> (C. B. Clarke) C. B. Clarke, as <i>Cyperus sulcinux</i> C. B. Clarke	C ₄	Govindarajalu 1978 ([A])
<i>P. uniolooides</i> (R. Br.) Urb., as <i>Cyperus uniolooides</i> R. Br. ^a	C ₄	Akita et al. 1969 ([A]); Govindarajalu 1978 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$); JB (Ac: <i>Bruhl, 16 Apr 1986 CANB</i>)
<i>Queenslandiella hyalina</i> (Vahl) Ballard, as <i>Cyperus hyalinus</i> Vahl ^a , as <i>Queenslandiella</i> ^b	C ₄	Lerman and Raynal 1972 (A) ^b ; Govindarajalu 1975b ([A]) ^a ; JB (Ac: <i>Bogdan 5353 K; Cooray 69121001R PDA; van Oostroom 13596 CANB</i>); LR ($\delta^{13}\text{C}$: -13.7, <i>Boivin s. n., ca. 1850</i>)
<i>Reedia spathacea</i> F. Muell.	C ₃	Takeda et al. 1985 (A); JB (A: <i>Maslin 1682c CANB</i>)
<i>Rhynchocladium steyermarkii</i> (T. Koyama) T. Koyama	C ₃	JB (A: <i>Davidse 27377 NY</i>)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>Rhynchospora affinis</i> W. Fitzg.	C ₄	Takeda et al. 1980 (Ar); Takeda et al. 1985 (Ar. $\delta^{13}\text{C}$); Ueno and Koyama 1987 (Ar)
<i>R. alba</i> (L.) Vahl	C ₃	Takeda et al. 1980 (A. Γ); Ueno and Koyama 1987 (A)
<i>R. albescens</i> (Miq.) Kük.	C ₃	Ueno and Koyama 1987 (A)
<i>R. albiceps</i> Kunth	C ₃	Ueno and Koyama 1987 (A)
<i>R. albomarginata</i> Kük.	C ₃	Ueno and Koyama 1987 (A)
<i>R. albotuberculata</i> Kük.	C ₄	Ueno and Koyama 1987 (Ar)
<i>R. amazonica</i> Poepp. & Kunth	C ₃	Ueno and Koyama 1987 (A)
<i>R. andina</i> Kük.	C ₃	Ueno and Koyama 1987 (A)
<i>R. angustifolia</i> Palla	C ₃	Ueno and Koyama 1987 (A)
<i>R. arechavaletae</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
" <i>R. argentina</i> Standley" [?= <i>R. argentea</i> Standley]	C ₃	Ueno and Koyama 1987 (A)
<i>R. aripoensis</i> Britton	C ₃	Ueno and Koyama 1987 (A)
<i>R. aristata</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. armerioides</i> J. Presl & C. Presl	C ₄ +	Ueno and Koyama 1987 (Ac); JB (Ac: <i>McKee 10847</i> CANB. $\delta^{13}\text{C}$: -10.0, <i>McKee 10847</i>)
<i>R. baldwinii</i> A. Gray	C ₃	Ueno and Koyama 1987 (A)
<i>R. barbata</i> (Vahl) Kunth	C ₄ +	Ueno and Koyama 1987 (Ac); JB (Ac: <i>King 721</i> CANB; <i>McKee 10573</i> CANB. $\delta^{13}\text{C}$: -10.4, -10.8, <i>King 721</i>)
<i>R. berteroi</i> (Spreng.) C. B. Clarke, as <i>R. pusilla</i> (Sw.) Griseb.	C ₃	Ueno and Koyama 1987 (A)
<i>R. biflora</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. brachychaeta</i> C. Wright	C ₃	Ueno and Koyama 1987 (A)
<i>R. brevirostris</i> Griseb.	C ₃	Ueno and Koyama 1987 (A)
<i>R. brownii</i> Roem & Schult., as <i>R. rugosa</i> ^a , as <i>R. rugosa</i> subsp. <i>brownii</i> (Roem. & Schult.) Koyama ^b	C ₃ +	Govindarajulu 1975a ([A]) ^a ; Gilliland and Gordon-Gray 1978 (US) ^a ; Takeda et al. 1980 (A. Γ) ^b ; Ueno and Koyama 1987 (A) ^a
<i>R. cacuminicola</i> Gale	C ₃	Ueno and Koyama 1987 (A)
<i>R. caduca</i> Elliott	C ₃	Ueno and Koyama 1987 (A)
<i>R. californica</i> Gale	C ₃	Ueno and Koyama 1987 (A)
<i>R. candida</i> (Nees) Boeck.	C ₃	Ueno and Koyama 1987 (A); LR ($\delta^{13}\text{C}$: -27.0, <i>Humbert 18779</i>)
<i>R. capillacea</i> Torr.	C ₃	Ueno and Koyama 1987 (A)
<i>R. capitata</i> (Kunth) Roem. & Schult.	C ₄	Ueno and Koyama 1987 (Ar)
<i>R. caracasana</i> (Kunth) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. cariciformis</i> Nees	C ₃	Ueno and Koyama 1987 (A)
<i>R. cephalantha</i> A. Gray (incl. <i>R. cephalantha</i> var. <i>pleiocephala</i> Fernald & Gale)	C ₃	Ueno and Koyama 1987 (A); JB (A: <i>Smith</i> , 17 Aug 1939 BRI. $\delta^{13}\text{C}$: -26.5, <i>Smith</i> , 17 Aug 1939)
<i>R. cephalotes</i> (L.) Vahl	C ₃	Ueno and Koyama 1987 (A); JB (A: <i>McKee 10709</i> CANB. $\delta^{13}\text{C}$: -26.9, -27.5, <i>McKee 10709</i>)
<i>R. cernua</i> Griseb.	C ₃	Ueno and Koyama 1987 (A)
<i>R. chalarocephala</i> Fernald & Gale	C ₃	Ueno and Koyama 1987 (A)
<i>R. chapmanii</i> M. A. Curtis	C ₃	Ueno and Koyama 1987 (A)
<i>R. chinensis</i> Nees & Meyen ex Wight	C ₃	Takeda et al. 1980 (A. Γ)
<i>R. fauriei</i> Franch., as <i>R. chinensis</i> subsp. <i>fauriei</i> (Franch.) Koyama	C ₃	Takeda et al. 1980 (A)
<i>R. ciliaris</i> (Michx.) Vahl	C ₃	Ueno and Koyama 1987 (A)
<i>R. ciliata</i> Vahl, as <i>R. nervosa</i> subsp. <i>ciliata</i> (Vahl) T. Koyama ^a , as <i>Dichromena ciliata</i> Vahl ^b	C ₃	Thomas 1984 (A) ^a ; LR ($\delta^{13}\text{C}$: -30.4, <i>Husnot 31</i>) ^b
<i>R. ciliolata</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. colorata</i> (L.) H. Pfeiff., as <i>R. stellata</i> (Lam.) Griseb. ^a	C ₃	Thomas 1984 (A); Ueno and Koyama 1987 (A) ^a ; JB (A: <i>s. coll.</i> MEL 1543827)
<i>R. comata</i> (Link) Roem. & Schult.	C ₃	Ueno and Koyama 1987 (A)
<i>R. compressa</i> J. Carey ex Chapm.	C ₃	Ueno and Koyama 1987 (A)
<i>R. confinis</i> (Nees) C. B. Clarke	C ₃	Ueno and Koyama 1987 (A)
<i>R. confusa</i> F. Ballard (<i>Syntrinema brasiliense</i> Radk. & H. Pfeiff.)	C ₄	Ueno and Koyama 1987 (Ar); JB (Ar, <i>Luetzelburg 1223</i> M. $\delta^{13}\text{C}$: -10.0, <i>Luetzelburg 1223</i>)
<i>R. consanguinea</i> (Kunth) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. coriifolia</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. corniculata</i> (Lam.) A. Gray	C ₃	Ueno and Koyama 1987 (A)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>R. corymbosa</i> (L.) Britton, as <i>R. aurea</i> Vahl ^a	C ₃	Hofstra et al. 1972 (A. Γ); Govindarajalu 1975a ([A]); Gilliland and Gordon-Gray 1978 (US); Prakash et al. 1976 (A) ^a ; Takeda et al. 1980 (A); Bruhl et al. 1987 (A. B); Ueno and Koyama 1987 (A); JB (A: <i>Bruhl 196</i> CANB; <i>Pullen 8152</i> CANB. Γ: 46, <i>Bruhl 196</i>)
<i>R. cubensis</i> Griseb.	C ₃	Ueno and Koyama 1987 (A)
<i>R. curtissii</i> Britton	C ₃	Ueno and Koyama 1987 (A)
<i>R. curvula</i> Griseb.	C ₄	Ueno and Koyama 1987 (Ar)
<i>R. cyperoides</i> (Sw.) Mart.	C ₃	Ueno and Koyama 1987 (A); JB (A: <i>Eggers</i> Jul 1881 BRI. δ ¹³ C: -25.5, <i>Eggers</i> , Jul 1881)
<i>R. decurrens</i> Chapm.	C ₃	Ueno and Koyama 1987 (A)
<i>R. dentinux</i> C. B. Clarke	C ₄	Ueno and Koyama 1987 (Ar)
<i>R. diamantina</i> C. B. Clarke ex Kük.	C ₄	Ueno and Koyama 1987 (Ar)
<i>R. dissitiflora</i> Steud.	C ₃	Ueno and Koyama 1987 (A)
<i>R. divergens</i> Chapm. ex M. A. Curtis	C ₃	Ueno and Koyama 1987 (A)
<i>R. dives</i> Standley, as <i>R. orizabensis</i> C. B. Clarke	C ₃	Ueno and Koyama 1987 (A)
<i>R. duckei</i> R. Gross	C ₃	Ueno and Koyama 1987 (A)
<i>R. ebracteata</i> (Standley) H. Pfeiff.	C ₃	Ueno and Koyama 1987 (A)
<i>R. elatior</i> Kunth	C ₄	Ueno and Koyama 1987 (Ar)
<i>R. elliotii</i> A. Dietrich, as <i>R. schoenoides</i> (Elliott) A. Wood	C ₃	Ueno and Koyama 1987 (A)
<i>R. elongata</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. emaciata</i> (Nees) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. exaltata</i> Kunth	C ₃	Ueno and Koyama 1987 (A)
<i>R. eximia</i> (Nees) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. faberi</i> C. B. Clarke	C ₃	Akita et al. 1969 ([A]); Takeda et al. 1980 (A. Γ); Ueno and Koyama 1987 (A)
<i>R. fascicularis</i> (Michx.) Vahl	C ₃	Ueno and Koyama 1987 (A)
<i>R. filifolia</i> A. Gray	C ₃	Ueno and Koyama 1987 (A)
<i>R. filiformis</i> Vahl, as <i>R. podosperma</i> C. Wright	C ₃	Ueno and Koyama 1987 (A)
<i>R. flexuosa</i> C. B. Clarke	C ₃	Ueno and Koyama 1987 (A)
<i>R. fusca</i> (L.) Aiton f.	C ₃	Ueno and Koyama 1987 (A)
<i>R. gigantea</i> Link	C ₃	Ueno and Koyama 1987 (A)
<i>R. glaziovii</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. globosa</i> (Kunth) Roem. & Schult.	C ₄	Ueno and Koyama 1987 (Ar)
<i>R. globularis</i> (Chapm.) Small	C ₃	Ueno and Koyama 1987 (A)
<i>R. glomerata</i> (L.) Vahl	C ₃	Ueno and Koyama 1987 (A)
<i>R. gollmeri</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. gracilentia</i> A. Gray	C ₃	Ueno and Koyama 1987 (A)
<i>R. gracillima</i> Thwaites	C ₃	Govindarajalu 1975a ([A]); Ueno and Koyama 1987 (A)
<i>R. graminea</i> Uittien	C ₃	Ueno and Koyama 1987 (A)
<i>R. grayi</i> Kunth	C ₃	Ueno and Koyama 1987 (A)
<i>R. grisebachii</i> Boeck. ex Urb.	C ₃	Ueno and Koyama 1987 (A)
<i>R. hassleri</i> C. B. Clarke	C ₃	Ueno and Koyama 1987 (A)
<i>R. heterocaulis</i> C. B. Clarke	C ₄	Ueno and Koyama 1987 (Ac)
<i>R. heterochaeta</i> S. T. Blake ^a , as <i>R. longisetis</i> R. Br. [voucher re-determined by K LW at NSW] ^b , as <i>R. wightiana</i> (Nees) Steud. [voucher <i>Ramos 21743</i> re-determined by K LW at NSW] ^c	C ₄	Takeda et al. 1980 (Ar) ^a ; Takeda et al. 1985 (Ar. δ ¹³ C) ^a ; Ueno and Koyama 1987 (Ar) ^{a,b,c} ; JB (Ar, <i>Bruhl 213</i> CANB) ^a
<i>R. hieronymii</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. hirsuta</i> Vahl	C ₃	Ueno and Koyama 1987 (A)
<i>R. hirta</i> (Nees) Boeck.	C ₄	Ueno and Koyama 1987 (Ac)
<i>R. hispidula</i> (Vahl) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. holoschoenoides</i> (Rich.) Herter	C ₃	Gilliland and Gordon-Gray 1978 (US); Takeda et al. 1980 (A)
<i>R. inexpansa</i> (Michx.) Vahl	C ₃	Ueno and Koyama 1987 (A)
<i>R. joveroensis</i> Britton	C ₃	Ueno and Koyama 1987 (A)
<i>R. junciformis</i> (Kunth) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. knieskernii</i> J. Carey	C ₃	Ueno and Koyama 1987 (A)
<i>R. kunthii</i> Nees ex Kunth	C ₃	Ueno and Koyama 1987 (A)
<i>R. lapensis</i> C. B. Clarke	C ₃	Ueno and Koyama 1987 (A)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>R. leae</i> C. B. Clarke	C ₄	Takeda et al. 1980 (Ar); Takeda et al. 1985 (Ar. δ ¹³ C); Ueno and Koyama 1987 (Ar)
<i>R. lechleri</i> Steud.	C ₃	Ueno and Koyama 1987 (A)
<i>R. leptorrhyncha</i> C. Wright	C ₃	Ueno and Koyama 1987 (A)
<i>R. lindeniana</i> Griseb.	C ₃	Ueno and Koyama 1987 (A)
<i>R. longibracteata</i> Rottb.	C ₃	Ueno and Koyama 1987 (A); JB (A: <i>McKee 107572</i> CANB. δ ¹³ C: -24.0, <i>McKee 107572</i>)
<i>R. longiflora</i> C. Presl	C ₃	Ueno and Koyama 1987 (A)
<i>R. longisetis</i> R. Br.	C ₄	Takeda et al. 1980 (Ar); Takeda et al. 1985 (Ar. δ ¹³ C)
<i>R. luzuliformis</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. macrochaeta</i> Steud.	C ₃	Ueno and Koyama 1987 (A)
<i>R. malasica</i> C. B. Clarke	C ₃	Takeda et al. 1980 (A); Ueno and Koyama 1987 (A)
<i>R. marisculus</i> Nees	C ₃	Ueno and Koyama 1987 (A)
<i>R. megalocarpa</i> A. Gray	C ₃	Ueno and Koyama 1987 (A)
<i>R. mexicana</i> (Liebm.) Steud.	C ₄	Ueno and Koyama 1987 (Ac)
<i>R. micrantha</i> Vahl	C ₃	Ueno and Koyama 1987 (A)
<i>R. microcarpa</i> Baldwin ex A. Gray	C ₃	Ueno and Koyama 1987 (A)
<i>R. miliacea</i> (Lam.) A. Gray	C ₃	Ueno and Koyama 1987 (A)
<i>R. mixta</i> Britton	C ₃	Ueno and Koyama 1987 (A)
<i>R. nardifolia</i> (Kunth) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. nervosa</i> (Vahl) Boeck., as <i>Dichromena nervosa</i> Vahl ^a	C ₃	Ueno and Koyama 1987 (A); JB (A: <i>s. coll.</i> MEL 153840); LR (δ ¹³ C: -34.1, Serre Orsay cult., 1972) ^a
<i>R. nipensis</i> Britton	C ₃	Ueno and Koyama 1987 (A)
<i>R. nitens</i> (Vahl) A. Gray	C ₃	Ueno and Koyama 1987 (A)
<i>R. nivea</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. odorata</i> C. Wright ex Griseb.	C ₃	Ueno and Koyama 1987 (A)
<i>R. oligantha</i> A. Gray	C ₃	Ueno and Koyama 1987 (A)
<i>R. organensis</i> C. B. Clarke, as <i>R. rostrata</i> Lindm.	C ₃	Ueno and Koyama 1987 (A)
<i>R. patuligluma</i> C. B. Clarke ex Lindm., as <i>R. pallida</i> (Nees) Steud.	C ₃	Ueno and Koyama 1987 (A)
<i>R. paraensis</i> Schrad. ex Kunth	C ₃	Ueno and Koyama 1987 (A)
<i>R. perrieri</i> Cherm.	C ₃	Gilliland and Gordon-Gray 1978 (US); Takeda et al. 1980 (A); Hesla et al. 1982 (δ ¹³ C); Ueno and Koyama 1987(A)
<i>R. pilosa</i> (Kunth) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. plumosa</i> Elliott	C ₃	Ueno and Koyama 1987 (A)
<i>R. polyantha</i> Steud.	C ₃	Ueno and Koyama 1987 (A)
<i>R. polyphylla</i> Vahl	C ₃	Ueno and Koyama 1987 (A)
<i>R. praecincta</i> Maury	C ₃	Ueno and Koyama 1987 (A)
<i>R. pruinosa</i> Griseb.	C ₃	Ueno and Koyama 1987 (A)
<i>R. pterochaeta</i> F. Muell.	C ₄	Takeda et al. 1980 (Ar); Takeda et al. 1985 (Ar. δ ¹³ C); Ueno and Koyama 1987 (Ar); KW (A: <i>Blake 13395</i>)
<i>R. pubera</i> (Vahl) Boeck.	C ₃	Thomas 1984 (A); Ueno and Koyama 1987 (A)
<i>R. punctata</i> Elliott	C ₃	Ueno and Koyama 1987 (A)
<i>R. pusilla</i> Chapm. ex M. A. Curtis ^a , as <i>R. intermixta</i> C. Wright ^b	C ₃	Ueno and Koyama 1987 (A) ^{a,b}
<i>R. racemosa</i> C. Wright	C ₃	Ueno and Koyama 1987 (A)
<i>R. radicans</i> (Schlecht. & Cham.) H. Pfeiff.	C ₃	Ueno and Koyama 1987 (A)
<i>R. radicans</i> subsp. <i>microcephala</i> (Bertero ex Spreng.) W. W. Thomas, as <i>R. microcephala</i> (Bertero ex Spreng.) Kük. ^a	C ₃	Thomas 1984 (A); Ueno and Koyama 1987 (A) ^a
<i>R. rariflora</i> (Michx.) Elliott	C ₃	Ueno and Koyama 1987 (A)
<i>R. recurvata</i> (Nees) Steud.	C ₃	Ueno and Koyama 1987 (A)
<i>R. reptans</i> (Rich.) Boeck., as <i>Dichromena reptans</i> (Rich.) Pers. ^a	C ₃	Thomas 1984 (A); Ueno and Koyama 1987 (A); LR (δ ¹³ C: -28.5, <i>Smith 2113</i>) ^a
<i>R. ridleyi</i> C. B. Clarke	C ₃	Ueno and Koyama 1987 (A)
<i>R. robusta</i> (Kunth) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. roraimae</i> Kük.	C ₃	Ueno and Koyama 1987 (A)
<i>R. rubra</i> (Lour.) Makino subsp. <i>rubra</i> , as <i>R. parva</i> (Nees) Steud. var. <i>boninensis</i> (Nakai ex Tuyama) T. Koyama ^a	C ₄	Govindarajulu 1975a ([A]); Takeda et al. 1980 (Ar. Γ); Takeda et al. 1980 (Ar) ^a ; Bruhl et al. 1987 (Ar. B); Gilliland and Gordon-Gray 1978 (USr); Ueno and Koyama 1987 (Ar); Ueno et al. 1986 (Ar. B); Ueno et al. 1988b (USr); Bruhl and Perry 1995 (USr); Soros and Dengler 2001 (Ar); JB (Ar, <i>Bruhl 573</i> CANB)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
subsp. <i>africana</i> J. Raynal	C ₄	Takeda et al. 1980 (Ar); SCV ($\delta^{13}\text{C}$: -10.21, <i>Schlechter 12090</i>)
<i>R. rufa</i> (Nees) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. rugosa</i> (Vahl) Gale	C ₃	Takeda et al. 1980 (A)
<i>R. schiedeana</i> (Schlecht.) Kunth	C ₃	Ueno and Koyama 1987 (A)
<i>R. schomburgkiana</i> (Boeck.) Koyama (<i>Micropapyrus viviparoides</i> Suess.)	C ₃	Ueno and Koyama 1987 (A); JB (A: <i>Luetzelburg 22381 M</i>)
<i>R. scirpoides</i> (Torr.) Griseb.	C ₃	Ueno and Koyama 1987 (A)
<i>R. sclerioides</i> Hook. & Arn.	C ₃	Ueno and Koyama 1987 (A)
<i>R. scutellata</i> Griseb. (<i>R. pringlei</i> Greenman)	C ₃	Ueno and Koyama 1987 (A); JB (A: <i>s. coll. MEL 1543836</i>)
<i>R. seslerioides</i> Griseb.	C ₃	Ueno and Koyama 1987 (A)
<i>R. setigera</i> (Kunth) Boeck.	C ₃	Ueno and Koyama 1987 (A); JB (A: <i>Montes 1173. $\delta^{13}\text{C}$: -27.6, -27.8, Montes 1173</i>)
<i>R. shaferi</i> Britton	C ₃	Ueno and Koyama 1987 (A)
<i>R. siquaneana</i> Britton	C ₃	Ueno and Koyama 1987 (A)
<i>R. simplex</i> (Kük.) Kük.	C ₃	Ueno and Koyama 1987 (A)
<i>R. solitaria</i> R. M. Harper	C ₃	Ueno and Koyama 1987 (A)
<i>R. sp.</i> (<i>McKee 10493 CANB</i>)	C ₃	JB (A. $\delta^{13}\text{C}$: -25.0, -25.1)
<i>R. sp.</i> A (<i>Wilson 5171</i>), as <i>R. exserta</i> C. B. Clarke ^a	C ₄	Ueno and Koyama 1987 (Ar) ^a ; KW (A)
<i>R. sp.</i> B (<i>Cowie 1123</i>)	C ₃	KW (A: <i>Cowie 1123, Craven 6196</i>)
<i>R. sp.</i> C (<i>Dunlop 5330</i>)	C ₄	KW (A)
<i>R. splendens</i> Lindm.	C ₃	Ueno and Koyama 1987 (A)
<i>R. stenocarpa</i> Kunth	C ₃	Ueno and Koyama 1987 (A)
<i>R. stenophylla</i> Chapm.	C ₃	Ueno and Koyama 1987 (A)
<i>R. subimberbis</i> Griseb.	C ₄	Ueno and Koyama 1987 (Ac)
<i>R. subplumosa</i> C. B. Clarke	C ₄	Ueno and Koyama 1987 (Ac#)
<i>R. subquadrata</i> Cherm.	C ₃	Ueno and Koyama 1987 (A)
<i>R. subtenuifolia</i> Kük., as <i>R. submarginata</i> Kük. [voucher re-determined by KLW at NSW] ^a , as <i>R. tenuifolia</i> Benth. non Griseb. ^b	C ₄	Takeda et al. 1980 (Ar) ^b ; Bruhl et al. 1987 (Ar. B); Ueno and Koyama 1987 (Ar) ^a ; Takeda et al. 1985 (Ar. $\delta^{13}\text{C}$) ^b ; JB (Ar, <i>Bruhl 344 CANB</i>)
<i>R. subtilis</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. tenella</i> (Nees) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. tenerrima</i> Nees ex Spreng. subsp. <i>tenerima</i> , as <i>R. setacea</i> (Berg) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. tenuifolia</i> Griseb.	C ₃	Ueno and Koyama 1987 (A)
<i>R. tenuis</i> Link	C ₃	Ueno and Koyama 1987 (A)
<i>R. terminalis</i> (Nees) Steud.	C ₄	Ueno and Koyama 1987 (Ar)
<i>R. torreyana</i> A. Gray	C ₃	Ueno and Koyama 1987 (A)
<i>R. trichochaeta</i> C. B. Clarke	C ₄	Ueno and Koyama 1987 (Ac)
<i>R. triflora</i> Vahl	C ₃	Ueno and Koyama 1987 (A)
<i>R. trispicata</i> (Nees) Schrad. ex Steud.	C ₃	Ueno and Koyama 1987 (A)
<i>R. tuerckheimii</i> C. B. Clarke	C ₃	Ueno and Koyama 1987 (A)
<i>R. umbraticola</i> Poepp. & Kunth	C ₃	Ueno and Koyama 1987 (A)
<i>R. uniflora</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. velutina</i> (Kunth) Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. viridilutea</i> C. B. Clarke	C ₃	Ueno and Koyama 1987 (A)
<i>R. vulcani</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. warmingii</i> Boeck.	C ₃	Ueno and Koyama 1987 (A)
<i>R. wightiana</i> (Nees) Steud.	C ₄	Bruhl et al. 1987 (Ar. B); Ueno and Koyama 1987 (A); JB (Ar, <i>Bruhl 404 CANB. Γ: 1, Bruhl 404</i>)
<i>R. wrightiana</i> Boeck.	C ₃ + C ₃	Govindarajalu 1975a ([A]) Ueno and Koyama 1987 (A)
<i>R. yasudana</i> Makino	C ₃	Ueno and Koyama 1987 (A)
subsp. <i>leviseta</i> T. Koyama	C ₃	Takeda et al. 1980 (A. Γ)
<i>Schoenoplectus americanus</i> (Pers.) Volkart ex Schinz & R. Keller, as <i>Scirpus olneyi</i> A. Gray	C ₃	Bender 1971 ($\delta^{13}\text{C}$)
<i>S. articulatus</i> (L.) Palla, as <i>Scirpus articulatus</i> L. ^a	C ₃	Govindarajalu 1976 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a ; Takeda et al. 1985 (A. $\delta^{13}\text{C}$) ^a ; LR ($\delta^{13}\text{C}$: -29.2, <i>Boivin s. n.</i> , ca. 1850)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>S. brachyceras</i> (Hochst. ex A. Rich.) K. Lye, as <i>Scirpus brachyceras</i> Hochst. ex A. Rich. ^a , as <i>Scirpus inclinatus</i> (Del.) Aschers. & Schweinf. ^b	C ₃	Govindarajalu 1976 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^b ; SCV ($\delta^{13}\text{C}$: -23.71, <i>Rogers 6431</i>)
<i>S. californicus</i> (C. A. Mey.) Soják, as <i>S. riparius</i> (J. Presl & C. Presl) Palla	C ₃	LR ($\delta^{13}\text{C}$: -25.4, <i>St Hilaire C2 2302</i> , -27.5, <i>Infantes 6228</i>)
<i>S. confusus</i> (N. E. Br.) K. Lye, as <i>Scirpus confusus</i> N. E. Br.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
subsp. <i>natalitius</i> J. Browning	C ₃	SCV ($\delta^{13}\text{C}$: -24.11, <i>Gibbs 106</i>)
<i>S. corymbosus</i> (Roem. & Schult.) J. Raynal	C ₃	LR ($\delta^{13}\text{C}$: -27.5, <i>Chevalier 8999</i>)
<i>S. dissachanthus</i> (S. T. Blake) J. Raynal, as <i>Scirpus dissachanthus</i> S. T. Blake	C ₃	Takeda et al. 1985 (A)
<i>S. junceus</i> (Willd.) J. Raynal, as <i>Scirpus aureiglumis</i> S. S. Hooper	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>S. juncooides</i> (Roxb.) Palla, as <i>Scirpus juncooides</i> Roxb.	C ₃	Govindarajalu 1976 ([A])
<i>S. lacustris</i> (L.) Palla	C ₃	Troughton et al. 1974 ($\delta^{13}\text{C}$); JB (A: <i>Holm-Nielsen</i> , 23 July 1970 BRI)
<i>S. laevis</i> (S. T. Blake) J. Raynal, as <i>Scirpus laevis</i> S. T. Blake	C ₃	Takeda et al. 1985 (A)
<i>S. lateriflorus</i> (J. F. Gmel.) K. Lye, as <i>Scirpus lateriflorus</i> J. F. Gmel. ^a	C ₃	Govindarajalu 1976 ([A]) ^a ; Takeda et al. 1985 (A) ^a ; JB (A: <i>Bruhl 454</i> CANB)
<i>S. lineolatus</i> (Franch. & Sav.) T. Koyama	C ₄ + C ₃	Hofstra et al. 1972 (A. Γ) Lin et al. 1993 (A)
<i>S. litoralis</i> (Schrud.) Palla, as <i>Scirpus litoralis</i> Schrad. ^a , as <i>Scirpus littoralis</i> [sic] ^b	C ₃	Govindarajalu 1976 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^b ; Takeda et al. 1985 (A) ^a ; Bruhl et al. 1987 (A. B); JB (A: <i>Bruhl 432</i> CANB. Γ : 46, <i>Bruhl 538</i> CANB)
<i>S. mucronatus</i> (L.) Palla ex Kerner, as <i>Scirpus mucronatus</i> L. ^a	C ₃	Govindarajalu 1976 ([A]) ^a ; JB (A: <i>Bruhl 460</i> , <i>538</i> CANB); LR ($\delta^{13}\text{C}$: -27.2, <i>Pobéguin 2191</i>)
<i>S. muricinux</i> (C. B. Clarke) J. Raynal	C ₃	KW (A: <i>Smook 6866</i>)
<i>S. paludicola</i> (Kunth) Palla	C ₃	KW (A: <i>Musil 105</i>)
<i>S. praelongatus</i> (Poir.) J. Raynal	C ₃	SCV ($\delta^{13}\text{C}$: -23.99, <i>Bolus 9476</i>)
<i>S. pulchellus</i> (Kunth) J. Raynal	C ₄ + C ₃	SCV ($\delta^{13}\text{C}$: -10.59, <i>Potts 1076</i>)
<i>S. pungens</i> (Vahl) Palla, as <i>Scirpus americanus</i> Pers.	C ₃	Takeda et al. 1985 (A)
<i>S. purshianus</i> (Fernald) M. T. Strong, as <i>Scirpus juncooides</i> Roxb.	C ₃	Lin et al. 1993 (A)
<i>S. roylei</i> (Nees) Ovczinn & Czukav., as <i>Scirpus roylei</i> (Nees) Parker ^a , as <i>Scirpus quinquefarius</i> Buch.-Ham. ex Boeck ^b	C ₃	Sabnis 1921 ([A]) ^b ; Govindarajalu 1976 ([A]) ^a ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^a
<i>S. senegalensis</i> (Steud.) J. Raynal, as <i>Schoenoplectus jacobii</i> (C. E. Fisch.) K. Lye ^a , as <i>Scirpus jacobii</i> C. E. Fisch. ^b , as <i>Scirpus jacobii</i> ^c	C ₃	Govindarajalu 1976 ([A]) ^b ; Hesla et al. 1982 ($\delta^{13}\text{C}$) ^c ; LR ($\delta^{13}\text{C}$: -27.5, <i>Heudelot 319</i>) ^a
<i>S. subulatus</i> (Vahl) K. Lye	C ₃	LR ($\delta^{13}\text{C}$: -27.2, <i>Trochain 3191</i>)
<i>S. supinus</i> (L.) Palla	C ₃	LR ($\delta^{13}\text{C}$: -27.9, <i>Sacleux 2561</i>)
<i>S. validus</i> (Vahl) A. Löve & D. Löve, as <i>Scirpus validus</i> Vahl ^a	C ₃	Bender 1971 ($\delta^{13}\text{C}$) ^a ; Govindarajalu 1976 ([A]) ^a ; JB (A: <i>Bruhl s. n.</i> , <i>Sullivan's Creek</i> CANB)
<i>S. wallichii</i> (Nees) T. Koyama	C ₃	Lin et al. 1993 (A)
<i>Schoenoxiphium lehmannii</i> (Nees) Steud.	C ₃	LR ($\delta^{13}\text{C}$: -30.6, <i>Napper 1931</i>)
<i>S. sparteum</i> (Wahlenb.) C. B. Clarke	C ₃	JB (A: <i>Smook 995</i> BRI. $\delta^{13}\text{C}$: -25.4, <i>Smook 995</i>); SCV ($\delta^{13}\text{C}$: -27.71, <i>Pegler 1196</i>)
<i>Schoenus acuminatus</i> (R. Br.) Nees	C ₃	KW (A: <i>Wilson 2960</i>)
<i>S. andrewsii</i> W. V. Fitzg.	C ₃	KW (A: <i>Fitzgerald</i> NSW 74075)
<i>S. apogon</i> Roem. & Schult.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); Ueno and Takeda 1992 (A); JB (A: <i>Bruhl</i> , <i>Black Mtn.</i> CANB); KW (A: <i>Gardner 924</i> ; <i>Ratkowsky 1576</i>)
<i>S. armeria</i> Nees	C ₃	KW (A: <i>Blake 18102</i>)
<i>S. asperocarpus</i> F. Muell.	C ₃	KW (A: <i>Wilson 3033</i>)
<i>S. benthamii</i> F. Muell.	C ₃	KW (A: <i>Fitzgerald</i> NSW 74033)
<i>S. bifidus</i> (Nees) Boeck.	C ₃	KW (A: <i>Wilson 3040</i>)
<i>S. breviculmis</i> Benth.	C ₃	Takeda et al. 1985 (A)
var. <i>tepperi</i> (F. Muell.) Kük.	C ₃	KW (A: <i>Beaulehole 49577</i> ; <i>Wilson 3157</i>)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>S. brevifolius</i> R. Br.	C ₃	Takeda et al. 1985 (A); KW (A: <i>Balansa</i> 700; <i>Johnson</i> 7476; <i>Petrie</i> NSW 149802); LR ($\delta^{13}\text{C}$: -28.6, <i>Filhol</i> 829)
<i>S. brevisetis</i> (R. Br.) Roem. & Schult.	C ₃	KW (A: <i>Wilson</i> 3058)
<i>S. caespitius</i> W. V. Fitzg.	C ₃	KW (A: <i>Wilson</i> 2884, 2978)
<i>S. calostachyus</i> (R. Br.) Roem. & Schult.	C ₃	Takeda et al. 1985 (A); Ueno and Takeda 1992 (A); KW (A: <i>Henty & Foreman</i> NGF 49405; <i>Wilson</i> 3693; <i>s. coll.</i> NSW 149804)
<i>S. calyptratus</i> Kük.	C ₃	KW (A: <i>Ratkowsky</i> 1583)
<i>S. carsei</i> Cheeseman	C ₃	KW (A: <i>Beaglehole</i> 33397; <i>Sinclair</i> NSW 149803)
<i>S. curvifolius</i> (R. Br.) Roem. & Schult.	C ₃	Takeda et al. 1985 (A); KW (A: <i>Coveny</i> 8185)
<i>S. curvulus</i> F. Muell.	C ₃	KW (A: <i>Elmer</i> 11379; <i>Frodin</i> NGF 26818)
<i>S. deformis</i> (R. Br.) Roem. & Schult.	C ₃	Takeda et al. 1985 (A); KW (A: <i>Beaglehole</i> 38249)
<i>S. discifer</i> Tate	C ₃	KW (A: <i>Newbey</i> 4861)
<i>S. efoliatus</i> F. Muell.	C ₃	KW (A: <i>Coveny</i> 8120; <i>Wilson</i> 2958)
<i>S. ericetorum</i> R. Br.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: <i>Blake</i> 10782 BRI); KW (A: <i>Blake</i> 15918; <i>Hamilton</i> NSW 74127)
<i>S. evansianus</i> K. L. Wilson	C ₃	KW (A: <i>Wilson</i> 1709)
<i>S. falcatus</i> R. Br.	C ₃	Takeda et al. 1985 (A); Ueno and Takeda 1992 (A); KW (A: <i>Beaglehole</i> 11486; <i>Ramos</i> BS32717)
<i>S. ferrugineus</i> L.	C ₃	KW (A: <i>Charpin</i> NSW 149911)
<i>S. fluitans</i> Hook. f.	C ₃	Takeda et al. 1985 (A)
<i>S. grammatophyllus</i> F. Muell.	C ₃	KW (A: <i>Blake</i> 17984)
<i>S. grandiflorus</i> Nees ex Lehm.	C ₃	KW (A: <i>Fitzgerald</i> NSW 4337; <i>Salasoo</i> 4017)
<i>S. hexandrus</i> F. Muell. & Tate	C ₃	KW (A: <i>Whaite</i> 4063)
<i>S. imberbis</i> (R. Br.) Poir.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: <i>Bruhl</i> , Grose Road CANB); KW (A: <i>Melville</i> 2769; <i>Tindale</i> NSW 18250)
<i>S. insolitus</i> K. L. Wilson	C ₃	KW (A: <i>Wilson</i> 2690)
<i>S. juvenis</i> C. B. Clarke	C ₃	KW (A: <i>Jaffré</i> 554)
<i>S. kennyi</i> F. M. Bailey	C ₃	Takeda et al. 1985 (A); KW (A: <i>Coveny</i> 10065; <i>Wilson</i> 3453)
<i>S. laevinux</i> (Kük.) Ohwi	C ₃	KW (A: <i>Croft</i> LAE 68984)
<i>S. lanatus</i> Labill.	C ₃	KW (A: <i>Coveny</i> 7986)
<i>S. latelaminatus</i> Kük.	C ₃	KW (A: <i>Beaglehole</i> 29865)
<i>S. latitans</i> S. T. Blake	C ₃	KW (A: <i>Wilson</i> 2625)
<i>S. lepidosperma</i> (F. Muell.) K. L. Wilson subsp. <i>lepidosperma</i>	C ₃	KW (A: <i>Archer</i> NSW 74168; <i>Corrick</i> 6176)
<i>S. lepidosperma</i> subsp. <i>pachylepis</i> (S. T. Blake) K. L. Wilson	C ₃	KW (A: <i>Coveny</i> 10477; <i>Hamilton</i> NSW 74162)
<i>S. maschalinus</i> Roem. & Schult.	C ₃	JB (A: <i>Bruhl</i> , 7 Oct 1986 CANB); KW (A: <i>Wilson</i> 3085)
<i>S. melanostachyus</i> R. Br.	C ₃	Takeda et al. 1985 (A); KW (A: <i>Constable</i> 5440, 5744)
<i>S. microcephalus</i> Kern	C ₃	KW (A: <i>McKee</i> 7990)
<i>S. minutulus</i> F. Muell.	C ₃	KW (A: <i>Crisp</i> 5213)
<i>S. moorei</i> Benth.	C ₃	KW (A: <i>Coveny</i> 2323, <i>Hamilton</i> NSW 149805)
<i>S. multiglumis</i> Benth.	C ₃	KW (A: <i>Wilson</i> 3007)
<i>S. neocaledonicus</i> C. B. Clarke	C ₃	KW (A: <i>MacKee</i> 21092)
<i>S. nigricans</i> L.	C ₃	Mateu Andres 1991 ([A]); KW (A: <i>Curtiss</i> 130; <i>Kneucker</i> 44a)
<i>S. nitens</i> (R. Br.) Roem. & Schult.	C ₃	Takeda et al. 1985 (A); KW (A: <i>Lucas</i> NSW 74160)
<i>S. obtusifolius</i> (Nees ex Lehm.) Boeck.	C ₃	KW (A: <i>Wilson</i> 2975)
<i>S. ornithopodioides</i> (Kük.) S. T. Blake	C ₃	KW (A: <i>Johnson</i> NSW 55308)
<i>S. paludosus</i> (R. Br.) Roem. & Schult. (<i>Tricostularia paludosa</i> (R. Br.) Benth.)	C ₃	Takeda et al. 1985 (A); JB (A: <i>Burbidge</i> , 4 Apr 1948 CANB); KW (A: <i>Blake</i> 13131; <i>Wilson</i> 3116)
<i>S. pauciflorus</i> (Hook. f.) Hook. f.	C ₃	KW (A: <i>Briggs</i> NSW 90812)
<i>S. pedicellatus</i> (R. Br.) Roem. & Schult.	C ₃	KW (A: <i>Fitzgerald</i> NSW 74348)
<i>S. pleiostemoneus</i> F. Muell.	C ₃	KW (A: <i>Coveny</i> 7811; <i>Wilson</i> 2626)
<i>S. punctatus</i> R. Br.	C ₃	KW (A: <i>Latz</i> 7397)
<i>S. racemosus</i> J. Black	C ₃	Takeda et al. 1985 (A)
<i>S. rigens</i> S. T. Blake	C ₃	KW (A: <i>Blake</i> 17985)
<i>S. scabripes</i> Benth.	C ₃	KW (A: <i>Coveny</i> 4961)
<i>S. sculptus</i> (Nees) Boeck.	C ₃	Takeda et al. 1985 (A)
<i>S. sesquispiculus</i> C. B. Clarke	C ₃	KW (A: <i>Newbey</i> 4207)
<i>S. sp. nov. A1</i> (<i>Crisp</i> 5589)	C ₃	KW (A: <i>Crisp</i> 5589)
<i>S. sp. nov. A2</i> (<i>Crisp</i> 5209)	C ₃	KW (A: <i>Crisp</i> 5209)
<i>S. sp. aff. brevifolius</i> (<i>Wilson</i> 3001)	C ₃	KW (A: <i>Wilson</i> 3001)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>S. sp. aff. brevisetis</i> (Wilson 2870)	C ₃	KW (A: Fitzgerald NSW 74087; Newbey 6493; Whittaker & Niering D68-6; Wilson 2870, 2926, 2935, 2977, 3014)
<i>S. sp. aff. elegans</i> S. T. Blake (Wilson 3041)	C ₃	KW (A: Wilson 3041)
<i>S. sp. aff. falcatus</i> (Lazarides 7859)	C ₃	KW (A: Lazarides 7859)
<i>S. sp. aff. laevigatus</i> (Crisp 4966)	C ₃	KW (A: Crisp 4966)
<i>S. sp. aff. lanatus</i> (Crisp 5472)	C ₃	KW (A: Crisp 5472)
<i>S. sp. aff. pleiostemoneus</i> (Wilson 2903)	C ₃	KW (A: Canning WA/68 7274; Coveny 3281, 3293a; Wilson 2903)
<i>S. sp. aff. punctatus</i> (Dunlop 4444)	C ₃	KW (A: Dunlop 4444)
<i>S. sp. aff. sparteus</i> (Henderson 1155)	C ₃	KW (A: Henderson 1155)
<i>S. sp. aff. subbarbatus</i> (Crisp 5284)	C ₃	KW (A: Crisp 5284)
<i>S. sp. aff. subfascicularis</i> (Wilson 2792)	C ₃	KW (A: Wilson 2792, 2877)
<i>S. sp. aff. trachycarpus</i> (Wilson 2904)	C ₃	KW (A: Wilson 2904)
<i>S. sp. nov.</i> 'Grey Rhizome' (Wilson 2922)	C ₃	KW (A: Wilson 2922)
<i>S. sp. nov.</i> 'Murchison' (Haegi 1952)	C ₃	KW (A: Haegi 1952)
<i>S. sparteus</i> R. Br.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$); Takeda et al. 1985 (A); KW (A: Blake 23116; Henty & Foreman NGF 49415)
<i>S. subaphyllus</i> Kük.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); KW (A: Cunningham 3309; Pickard 2495)
<i>S. subbarbatus</i> Kük.	C ₃	KW (A: Wilson 2976)
<i>S. subbarbatus</i> Kük vel sp. nov. aff.	C ₃	KW (A: Wilson 2864)
<i>S. subbulbosus</i> Benth.	C ₃	KW (A: Wilson 2959)
<i>S. subfascicularis</i> Kük.	C ₃	KW (A: Wilson 2700, 2724)
<i>S. subflavus</i> Kük. vel sp. nov. aff.	C ₃	KW (A: Wilson 2603, 2776, 2923)
<i>S. sublaxus</i> Kük.	C ₃	KW (A: Wilson 2885)
<i>S. submicrostachyus</i> Kük.	C ₃	KW (A: Wilson 2871)
<i>S. tendo</i> (Hook. f.) Hook. f. var. <i>triander</i> Kük.	C ₃	KW (A: Franc 2174)
<i>S. tesquorum</i> J. Black	C ₃	KW (A: Melville 1935)
<i>S. trachycarpus</i> F. Muell.	C ₃	KW (A: Melville 4408)
<i>S. turbinatus</i> (R. Br.) Roem. & Schult.	C ₃	KW (A: Blake 7490; Rodway NSW 74069)
<i>S. unispiculatus</i> F. Muell. ex Benth.	C ₃	KW (A: Blake 18101)
<i>S. vaginatus</i> F. Muell. ex Benth.	C ₃	KW (A: Sharpe 2409)
<i>S. villosus</i> R. Br.	C ₃	Takeda et al. 1985 (A); KW (A: Blakely NSW 74308; Boorman NSW 122302)
<i>Scirpodendron ghaeri</i> (Gaertn.) Merr.	C ₃	Koyama 1967 ([A]); Takeda et al. 1985 (A); JB (A: White BSIP 75 CANB; Stevens LAE 58624); KW (A: Wilson 10194); LR ($\delta^{13}\text{C}$: -25.1, -25.6, Buwalda 5861)
<i>Scirpoides holoschoenus</i> (L.) Soják, as <i>Holoschoenus vulgaris</i> Link ^a , as <i>Scirpus holoschoenus</i> L. ^b	C ₃	Mateu Andres 1991 ([A]) ^b ; JB (A: Caine NSW 181479); LR ($\delta^{13}\text{C}$: -27.4, Bourgeau 490) ^a
<i>Scirpus macrolepis</i> Philippi [= <i>Phylloscirpus acaulis</i> ; S. Dhooge, pers. comm.]	C ₃	Ponessa et al. 1997 ([A])
<i>S. polystachyus</i> F. Muell.	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: Austin 86 CANB; Bruhl 25 CANB)
<i>S. sylvaticus</i> L.	C ₃	LR ($\delta^{13}\text{C}$: -27.5, Maire s. n., La Ferté Alais, 1841)
<i>Scleria abortiva</i> Nees ex Kunth	C ₃	Chermezon 1926 ([A])
<i>S. angusta</i> Nees ex Kunth	C ₃	SCV ($\delta^{13}\text{C}$: -29.19, Wood 3863)
<i>S. bancana</i> Miq.	C ₃	Prakash et al. 1976 (A)
<i>S. brownii</i> Kunth	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$)
<i>S. bulbifera</i> A. Rich.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>S. ciliaris</i> Nees	C ₃	Takeda et al. 1985 (A. $\delta^{13}\text{C}$); JB (A: Bruhl 295, 505 CANB; Hyland 8380 CANB. Γ : 46, Bruhl 295, 52, Bruhl 505)
<i>S. corymbosa</i> Roxb.	C ₃	Govindarajalu 1975a ([A])
<i>S. distans</i> Poir., as <i>S. nutans</i> Willd. ex Kunth	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>S. foliosa</i> A. Rich.	C ₃	Hesla et al. 1982 ($\delta^{13}\text{C}$)
<i>S. graeffeana</i> Boeck.	C ₃	JB (A: Christan 3 CANB)
<i>S. greigiifolia</i> (Ridl.) C. B. Clarke (<i>Acriulus greigiifolius</i> Ridl.)	C ₃	JB (A: Haines 129 K); LR ($\delta^{13}\text{C}$: -26.3, Angus 2725); SCV ($\delta^{13}\text{C}$: -25.98, Stohr 427)
<i>S. iostephana</i> Nelmes	C ₃	LR ($\delta^{13}\text{C}$: -28.6, Liben 2191)
<i>S. levis</i> Retz.	C ₃	Govindarajalu 1975a ([A]); Takeda et al. 1985 (A); Bruhl et al. 1987 (A. B); Ehleringer et al. 1987 ($\delta^{13}\text{C}$); JB (A: Bruhl 522 CANB; Dunlop 5877 CANB. Γ : 45, Bruhl 227 CANB)

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>S. lithosperma</i> (L.) Sw., as <i>S. lithosperma</i> var. <i>lithosperma</i> ^a	C ₃	Govindarajalu 1975a ([A]) ^a ; Prakash et al. 1976 (A); Hesla et al. 1982 (δ ¹³ C); Takeda et al. 1985 (A. δ ¹³ C)
var. <i>linearis</i> Benth.	C ₄ ⁺	Hofstra et al. 1972 (A. Γ); Raghavendra and Das 1976 (A)
var. <i>multispiculata</i> Govindarajalu	C ₃	Govindarajalu 1975a ([A])
var. <i>muricata</i> Govindarajalu	C ₃	Govindarajalu 1975a ([A])
<i>S. mackaviensis</i> Boeck.	C ₃	Takeda et al. 1985 (A)
<i>S. melanophala</i> Kunth	C ₃	Hesla et al. 1982 (δ ¹³ C)
<i>S. mikawana</i> Makino	C ₃	LR (δ ¹³ C: -32.0, <i>Robinson 3582</i>)
<i>S. novaehollandiae</i> Boeck.	C ₃	Takeda et al. 1985 (A. δ ¹³ C)
<i>S. poaeoides</i> Ridl.	C ₃	Hesla et al. 1982 (δ ¹³ C)
<i>S. poiiformis</i> Retz.	C ₃	Govindarajalu 1975a ([A])
<i>S. racemosa</i> Poir.	C ₃	Hesla et al. 1982 (δ ¹³ C)
<i>S. rehmannii</i> C. B. Clarke	C ₃	SCV (δ ¹³ C: -23.86, <i>Bolus 1893</i>)
<i>S. rugosa</i> R. Br.	C ₃	Takeda et al. 1985 (A)
<i>S. sphacelata</i> F. Muell.	C ₃	Takeda et al. 1985 (A); JB (A: <i>Bruhl 515</i> CANB; <i>Craven 5599</i> CANB)
<i>S. sumatrensis</i> Retz.	C ₃	Koyama 1967 ([A]); Govindarajalu 1975a ([A])
<i>S. terrestris</i> (L.) Fass.	C ₃	Govindarajalu 1975a ([A]); Ehleringer et al. 1987 (δ ¹³ C)
<i>S. tessellata</i> Willd.	C ₃	Govindarajalu 1975a ([A])
<i>S. transvaalensis</i> E. F. Franklin	C ₃	SCV (δ ¹³ C: -25.11, <i>Meyer 15</i>)
<i>S. tricuspidata</i> S. T. Blake	C ₃	Takeda et al. 1985 (A)
<i>Sphaerocyperus erinaceus</i> (Ridl.) K. Lye, as <i>Cyperus erinaceus</i> (Ridl.) Kük. ^a	C ₄	Druyts-Voets 1970 ([Ac]) ^a ; Lerman and Raynal 1972 (A) ^a ; JB (Ac: <i>Richards 15066</i> K); KW (Ac: <i>Robinson 3553</i> P); LR (δ ¹³ C: -11.7, <i>Gossweiler 4229</i>)
<i>Sumatrosclirpus junghuhnii</i> (Miq.) Oteng-Yeboah	C ₃	BW (A: <i>de Wilde 15236</i> L)
<i>Tetaria capillaris</i> (F. Muell.) J. M. Black	C ₃	Takeda et al. 1985 (A. δ ¹³ C); JB (A: <i>Blake 15846</i> CANB); KW (A: <i>Coveny 6244</i> ; <i>McBarron 11442</i>); LR (δ ¹³ C: -28.1, <i>X . . . s. n.</i> , Port Jackson, 1900)
<i>T. compacta</i> Levyns	C ₃	SCV (δ ¹³ C: -24.49, <i>Levyns 8726</i>)
<i>T. cuspidata</i> (Rottb.) C. B. Clarke	C ₃	LR (δ ¹³ C: -28.2, <i>Schlechter 7429</i>)
<i>T. exilis</i> Levyns	C ₃	JB (A: <i>Schlechter 7341</i>); SCV (δ ¹³ C: -25.94, <i>Levyns 6229</i>)
<i>T. natalensis</i> (C. B. Clarke) Koyama	C ₃	SCV (δ ¹³ C: -25.80, <i>Rogers 19183</i>)
<i>T. octandra</i> (Nees) Kük. (<i>Tetariopsis octandra</i> (Nees) C. B. Clarke)	C ₃	JB (A: <i>Blake 2240</i> CANB; <i>Seabrook 130</i> CANB; <i>P.G. Wilson 3965</i> CANB)
<i>Trachystylis stradbrokeensis</i> S. T. Blake	C ₃	JB (A: <i>Blake 22673</i> BRI; <i>Clarkson 5156</i> BRI; <i>Perry 439</i> CANB. δ ¹³ C: -29.8, <i>Clarkson 5156</i>); LR (δ ¹³ C: -26.7, <i>Blake 13201</i>)
<i>Trianoptiles capensis</i> (Steud.) Harvey	C ₃	JB (A: <i>Parker 4132</i> K); LR (δ ¹³ C: -27.6, <i>Schlechter 9137</i>); SCV (δ ¹³ C: -28.02, <i>Levyns 7762</i>)
<i>T. solitaria</i> (C. B. Clarke) Levyns	C ₃	SCV (δ ¹³ C: -25.82, <i>Esterhuysen 34682</i>)
<i>T. stipitata</i> Levyns	C ₃	SCV (δ ¹³ C: -29.24, <i>Levyns 7678</i>)
<i>Trichophorum alpinum</i> (L.) Pers.	C ₃	LR (δ ¹³ C: -26.1, <i>De la Pylaie 1643</i>)
<i>T. cespitosum</i> (L.) Hartm., (<i>Baeothryon caespitosum</i> (L.) A. Dietrich), as <i>Scirpus cespitosus</i> L. ^a	C ₃	Bender 1971 (δ ¹³ C) ^a ; JB (A: <i>Townsend 73/154</i> PDA); LR (δ ¹³ C: -27.1, <i>Lerman s. n.</i> , Oetzal, 1971)
<i>T. subcapitatum</i> (Thwaites) D. A. Simpson, as <i>Scirpus subcapitatus</i> Thwaites	C ₃	Govindarajalu 1976 ([A])
<i>Trichoschoenus bosseri</i> J. Raynal	C ₃	LR (δ ¹³ C: -24.9, <i>Humbert 28576</i>)
<i>Tricostularia compressa</i> Nees ex Lehm.	C ₃	Takeda et al. 1985 (A. δ ¹³ C)
<i>T. pauciflora</i> (F. Muell.) Benth.	C ₃	Takeda et al. 1985 (A); JB (A: <i>Willis, 1 Oct 1959</i> CANB)
<i>T. undulata</i> (Thwaites) J. Kern	C ₃	Takeda et al. 1985 (A. δ ¹³ C); JB (A: <i>Bruhl 325</i> CANB); LR (δ ¹³ C: -26.5, <i>Evrard 2315</i>)
<i>Trilepis lhotzkiana</i> Nees	C ₃	JB (A: <i>Harley 19425</i> K; LR (δ ¹³ C: -28.7, <i>Weddell 471</i>)
<i>Uncinia angustifolia</i> Hamlin	C ₃	Kukkonen 1967 ([A])
<i>U. brevicaulis</i> Thouars	C ₃	Kukkonen 1967 ([A])
<i>U. compacta</i> R. Br.	C ₃	JB (A: <i>Bruhl 634</i> CANB; <i>Smith 15531</i> CANB); KW (A: <i>Thompson 4048</i>)
<i>U. dawsonii</i> Hamlin	C ₃	LR (δ ¹³ C: -32.8, <i>MacKee 9783</i>)
<i>U. divaricata</i> Boott	C ₃	Kukkonen 1967 ([A]); KW (A: <i>Seppelt 12453</i>)
<i>U. elegans</i> (Kük.) Hamlin	C ₃	KW (A: <i>Rodway</i> NSW 52591)
<i>U. erinacea</i> (Cav.) Pers.	C ₃	Kukkonen 1967 ([A])
<i>U. flaccida</i> S. T. Blake	C ₃	Takeda et al. 1985 (A. δ ¹³ C); KW (A: <i>Thompson 3025</i>)
<i>U. hamata</i> (Schwartz) Urb.	C ₃	Kukkonen 1967 ([A])

Appendix 1. Continued.

Species	Photosynthetic pathway	References (method: value [as appropriate], voucher [if new record])
<i>U. hookeri</i> Boott	C ₃	KW (A: <i>Seppelt 12101, 12681</i>)
<i>U. nemoralis</i> K. L. Wilson	C ₃	KW (A: <i>Coveny 5913</i>)
<i>U. nervosa</i> Boott	C ₃	KW (A: <i>Druce CHR 131588</i>)
<i>U. riparia</i> R. Br.	C ₃	KW (A: <i>Ratkowsky 1596</i>)
<i>U. sp. nov. aff. filiformis</i> Colenso ex Boott (<i>Blake 18413</i>)	C ₃	KW (A: <i>Blake 18413</i>)
<i>U. sulcata</i> K. L. Wilson	C ₃	KW (A: <i>Pickard & Coveny 2749</i>)
<i>U. tenella</i> R. Br.	C ₃	Kukkonen 1967 (IA); Takeda et al. 1985 (A); KW (A: <i>Gray 5403</i>)
<i>U. uncinata</i> (L. f.) Kük.	C ₃	Kukkonen 1967 (IA)
<i>Volkiella disticha</i> Merxm. & Czech., as <i>Volkiella</i> ^a	C ₃	Lerman and Raynal 1972 (A) ^a ; JB (A: <i>Mueller 493 PRE</i>); LR ($\delta^{13}\text{C}$: -13.6, <i>Volk 1815</i>)
<i>Websteria confervoides</i> (Poir.) S. S. Hooper, as <i>Websteria</i> ^a	C ₃	Lerman and Raynal 1972 (A) ^a ; JB (A: <i>Smith 1797 PRE</i>); LR ($\delta^{13}\text{C}$: -23.3, <i>Hallé & Guillaumin s. n.</i> , Moossou, Côte d'Ivoire, 1960)
<i>Zameioscirpus muticus</i> Dhooge & Goetgh.	C ₃	Dhooge et al. 2003 (A)

APPENDIX 2: Assessment of Conflicting Data on Photosynthetic Pathway Status in Cyperaceae

Our survey of literature on photosynthetic pathways in Cyperaceae found various inconsistent records. We have seen some but not all of the vouchers for these records. However, in most, perhaps all, of these cases we concluded that they resulted from misidentification of the material used or misapplication of names, rather than the species concerned being variable in this regard. See, for example, the discussion below about records of *Cyperus eragrostis*, which we suggest involved confusion in usage of that name. These suspect records are tagged in Appendix 1 with “+”.

Carex.—Smith and Epstein's (1971) C₄ $\delta^{13}\text{C}$ value for an unnamed *Carex* species is at variance with all other available data for that genus, including one biochemically typed species, $\delta^{13}\text{C}$ value determinations for 33 species, anatomical data for 48 species and Γ values for eight species.

Cyperus s.l.—*Cyperus aggregatus* was reported as C₃ by Li et al. (1999). This species, previously known as *C. flavus* (Vahl) Nees or *C. cayennensis* (Lam.) Britton, is C₄, as are all the other species so far as known in Kükenthal's (1935, 1936) *Cyperus* sect. *Mariscus* apart from *C. deciduus* (see below).

Cyperus albostratus was reported as C₄ by Sonnenberg and Botha (1992) but our samples (Appendix 1) show this to be C₃, as are all the other species sampled in Kükenthal's (1935, 1936) *Cyperus* sect. *Diffusi*.

Cyperus deciduus was treated by Kükenthal (1935, 1936) as a member of *Cyperus* subgen. *Mariscus*, mainly on account of its spikelets falling as a unit as in other species in that subgenus as traditionally circumscribed. However, its characteristics, including non-Kranz anatomy, suggest that it is better placed with the “C₃” species of *Cyperus* in subgen. *Pycnostachys* (Wilson 1991). Vorster (1990, 1996) reported unusual anatomy in this species, with a partial inner chlorenchymatous sheath as in Kranz anatomy. However, the “maximum cells distant” count is in accord with non-Kranz anatomy. Further study of this unusual species is warranted.

Conflicting data have been presented in the literature for *C. eragrostis* (Appendix 1). The C₄ values were obtained from one laboratory. We sampled two Australian and two New Zealand accessions of *C. eragrostis*. All four proved to be C₃, with C₃ anatomy (Appendix 1), very low or undetectable levels of C₄ acid decarboxylating enzymes (Bruhl et al. 1987) and with Γ and $\delta^{13}\text{C}$ values (Appendix 1) typical of a C₃ species. It seems, therefore, that *C. eragrostis* is C₃. The C₄ records may result from the misapplication of that name to *C. sanguinolentus* Vahl, which was commonly

known as *C. eragrostis* Vahl (non Lam.) in Europe over the last couple of centuries (Kukkonen 1995).

Cyperus glaber was listed by Li (1993) as C₃. However, other records show this to be a C₄ species, as are all the other species in Kükenthal's (1935, 1936) *Cyperus* sect. *Compressi*.

Cyperus glomeratus was reported to be C₃ by Li (1993), but other studies record this as C₄, as are all the other species (so far as known) in Kükenthal's *Cyperus* sect. *Distantes*.

For *C. papyrus*, both C₃ and C₄ determinations were obtained from several laboratories (Appendix 1). Our own anatomical observations on two accessions support the C₄ status of this species, in agreement with Lerman and Raynal (1972; Appendix 1) and Jones and Milburn (1978). We wonder whether the C₃ determinations were made on the morphologically somewhat similar *C. prolifer* or *C. involucratus*, both of which are commonly cultivated and are sometimes known as “papyrus” (or “dwarf papyrus” in the case of the former species).

The C₄ record for *C. pulchellus* of Lerman and Raynal (1972; Appendix 1) is at odds with C₃ $\delta^{13}\text{C}$ values obtained for this species by Hesla et al. (1982) and Takeda et al. (1985) and anatomical observations of several workers. Plants of this species have been misidentified as species of *Lipocarpa* (C₄), *Ascolepis* (C₄) and *Kyllingiella* (C₃) (Haines and Lye 1983).

Cyperus textilis was reported as C₄ by Li (1993). However, another study records this as C₃, which is in line with the other species in Kükenthal's (1935, 1936) *Cyperus* sect. *Vaginati*.

Li and Jones (1994) reported a form of C₄ anatomy that they called Kranzketten (literally “chain of garlands”) from the arrangement of the vascular bundles so that they form a “ring” around airspaces as seen in cross-section. This anatomical type is indeed interesting, but the paper is unsatisfactory in several ways. Firstly, in discussing this unusual anatomy, they fail to mention Metcalfe's (1971: 382) designation of the extreme form of this as “*Mariscus* A-type anatomy” (characterized by adaxial epidermal cells being of similar size to those of the abaxial layer; and with vascular bundles surrounding air spaces). This type of anatomy was also distinguished by Bruhl et al. (1992) as “vascular bundles forming ‘ring’ or ‘horse-shoe’ patterns”. As discussed by Wilson (1991), it is present in species of *Cyperus* sections *Pinnati*, *Glutinosi*, *Thunbergiani* and *Turgiduli* p.p. (sectional names as in Kükenthal [1935, 1936]). The form described by Li and Jones (1994) is the same as described and illustrated by Metcalfe (1971: 316, Fig. 42F) for *C. serotinus* under the name *Juncellus serotinus* (Rottb.) C. B. Clarke. Secondly, it is not clear what species the authors were studying. They named it *C. japonicus* Makino, but that name is a synonym of *C. microiria* Steud. which has “ordinary” C₄ anatomy with a single row of vas-

cular bundles in the two specimens examined by the current authors. Indeed, all the other species examined in *Cyperus* sect. *Iriae* (as updated by the current authors from Kükenthal [1935, 1936]: *C. amuricus*, *C. alulatus* Kern, *C. iria*) have this type of C_4 anatomy, except for *C. orthostachys*, which has *Mariscus* A-type (“Kranz-kette”) anatomy in the outer quarter of its leaves but a single row of vascular bundles closer to the midrib, as seen in cross-section. *Cyperus orthostachys* is also an Asian species, so perhaps Li and Jones were using that species. However, a more likely alternative is that their material was of *C. serotinus*, mentioned above, which also grows in Asia and exhibits a well-developed example of this type of anatomy.

Eleocharis.—The evidence for the C_4 status of *E. retroflexa* is compelling with 20 records including assessment of anatomy, ultrastructure, biochemistry and $\delta^{13}C$ value determinations (Appendix 1). By contrast the semi-diagrammatic drawing by Govindarajulu (1975a: Fig. 1a) suggests C_3 status due to a “maximum cells distant” count of greater than one. His tissue map and description of the vascular bundles for this species do not help resolve this conflict which most likely stems from the breakdown of the “one cell distant” criterion in *Eleocharis*, as discussed in the main text.

We present three anatomical records and four $\delta^{13}C$ value determinations for *E. subcancellata* that clearly indicate this species is C_4 . In contrast, Ueno et al. (1989: 430) presented one anatomical and one $\delta^{13}C$ value assessment of this species and assigned the species as “ $C_3?$ ”. Their typical C_3 value of -23.2 for *E. subcancellata* indicates that either the specimen was incorrectly identified or this species is another member of the genus that is variable for photosynthetic pathway (see discussion on *Eleocharis* in the text) and worthy of detailed study.

Lipocarpha.—This genus is generally C_4 , with reports for 12 species cited in Appendix 1. The report of C_3 for a species of *Lipocarpha* (Stock et al. 2004) from a single $\delta^{13}C$ value for *L. rehmannii* (Appendix 1) is at odds with four other records for the species based on anatomical observations and $\delta^{13}C$ values, and with the other species in the genus. The specimen in question appears to be a collection of multiple individuals but with all components matching other material of *L. rehmannii* at BOL (A. Verboom, pers. comm., Aug 2004). These specimens are in need of anatomical study and broader sampling for $\delta^{13}C$ values.

Pycneus.—*Pycneus flavescens* (as *Cyperus flavescens*) was reported as being C_3 by Li (1993). However, other reports for this species record it as C_4 , as are all known members of the genus *Pycneus* (*Cyperus* subgen. *Pycneus*).

Saxena and Ramakrishnan (1984) reported *P. flavidus* (as *P. globosus*) as anatomically C_3 . By contrast, all other evidence (including

ultrastructural, physiological, biochemical, and further anatomical characteristics) reported for this species and the genus in general (Appendix 1) indicate C_4 . It is possible that Saxena and Ramakrishnan sampled a specimen of the C_3 species *Cyperus tenuispica*, which has at times in the past been known (erroneously) as *Cyperus flavidus*.

Rhynchospora.—The Γ values presented by Takeda et al. (1980) for 17 species of *Rhynchospora* include values that are higher than classic C_4 values (for species with rhynchosporoid anatomy, e.g., *R. rubra*: $10 \mu\text{L liter}^{-1}$), and that are lower than typical C_3 values (e.g., *R. brownii*: $32 \mu\text{L liter}^{-1}$). Such values are usually indicative of C_3 - C_4 intermediates (Hattersley et al. 1986) (Appendix 1: cf. *Eleocharis pusilla*). Indeed the two values fall outside the range of values Takeda et al. (1980: 57) obtained for control species: i.e., “less than $10 \mu\text{L l}^{-1}$ (for C_4 species) and . . . more than $40 \mu\text{L l}^{-1}$ for C_3 species”, though they did not query these results. More recent anatomical and biochemical investigations of *R. rubra* have, however, corroborated its C_4 status (Bruhl et al. 1987; Ueno and Koyama 1987).

The $\delta^{13}C$ values and C_4 anatomy (Appendix 1) for *R. armerioides* and *R. barbata* confirm that *Rhynchospora* species with chlorocyperoid anatomy are also consistently C_4 , as Ueno and Koyama (1987) initially reported (see also Bruhl et al. 1987; Bruhl 1995).

Schoenoplectus.—The listing by Hofstra et al. (1972) of *S. lateriflorus* as C_4 , based on C_4 anatomy and a low Γ value, conflicts with other observations for this species (Appendix 1), and for the 26 other species surveyed. Our anatomical observations do not indicate even remotely C_4 -like anatomy for *S. lateriflorus*.

The C_4 $\delta^{13}C$ value for *S. pulchellus* is the first report for this species. The specimen in question is not mixed and appears to have been correctly identified by cyperologist Jane Browning (A. Verboom, pers. comm., Aug 2004). Hayasaka (2002) puts *S. pulchellus* in the “*S. corymbosus* complex” of species (viz. *S. brachyceras*, *S. confusus*, *S. corymbosus*, *S. decipiens* (Nees) J. Raynal, *S. muricunux*, *S. muriculatus* (Kük.) J. Browning, *S. paludicola*, and *S. pulchellus*) on morphological grounds. The five other species of the complex so far sampled are C_3 (Appendix 1), and we suspect that *S. pulchellus* will also prove to be C_3 . Nevertheless, the photosynthetic pathway of all species of *Schoenoplectus* clearly merits assessment.

Scleria.—Variation in photosynthetic pathway has also been reported for *S. lithosperma* (Appendix 1), but “these discrepancies . . . may have resulted from identificatory error of plant materials” (Takeda et al. 1985: 405). Another 20 species of *Scleria* appear in the literature as C_3 , and our anatomical observations and Γ values (Appendix 1) for *Scleria* also support the contention that the genus is wholly C_3 .