http://dx.doi.org/10.1590/1519-6984.03714BM Original Article

Additional list of species of aquatic macrophytes in the lower basin of the Xingu River

Abe, DS.[a], Sidagis-Galli, C.[a], Matsumura-Tundisi, T.[a], Tundisi, JEM.[a], Blanco, FP.[a], Faria, CRL.[a] and Tundisi, JG.[a]*

[a]Instituto Internacional de Ecologia e Gerenciamento Ambiental – IIEGA, Rua Bento Carlos, 750, Centro, CEP 13560-660, São Carlos, SP, Brazil

*e-mail: donatoabe@iie.com.br

Received: July 10, 2015 – Accepted: August 10, 2015 – Distributed: August 31, 2015
(With 2 figures)

Abstract

In this paper the authors present an additional list of aquatic macrophytes in the lower basin of the Xingu River.

Keywords: macrophytes, lower Xingu River.

Lista adicional de macrófitas aquáticas do baixo Rio Xingu

Resumo

Neste trabalho os autores apresentam uma lista adicional de macrófitas aquáticas no baixo Rio Xingu.

Palavras-chave: macrófitas, baixo Rio Xingu.

1. Introduction

The lower stretch of the Xingu River is characterized by a diversity of habitats, with large uneven rapids, a series of anastomosing channels, oxbow lakes and high amount of tributaries. This heterogeneity generates hydrological and limnological conditions that allow the occurrence of a variety of aquatic macrophytes.

In the article by Medeiros et al. (2015) presented in this special issue, the authors also conducted a survey of the species of aquatic weeds that occur in the same region. However, in this study the authors gave greater emphasis on closely related species to water bodies, since the main objective was to evaluate the species with great potential for infestation and that could cause problems in areas of the reservoirs under construction in the Xingu River.

In the present study, the sampling efforts were directed to a wider area including wetlands, parafluvial zone of the Xingu River, as well as the edges of islands and stretches of the Xingu river rapids. Therefore, it is a complement of the previous survey conducted by Medeiros et al. (2015).

2. Methods

This survey is part of the monitoring program that is being conducted in the influence areas of the Belo Monte hydroelectric dam. Sampling of aquatic macrophytes was carried out in four campaigns, considering one full hydrological cycle: October of 2014 (dry), January (flood), April (full) and July of 2015 (ebb) (Figure 1).

The species list followed the classification of families proposed by APG III (2009) for angiosperms, by Smith et al. (2006) for pteridophytes, and Buck and Goffinet (2000) for bryophytes. Plant names and respective authors were checked at the data bank of the Botanical Garden o Rio de Janeiro (Reflora, 2015).

A total of 189 species of aquatic macrophytes were observed (Table 1). The most represented families were Fabaceae (27 species), Cyperaceae (26 species), Poaceae (22 species) and Rubiaceae (10 species) (Figure 2). Amphibious forms were dominant (60%), followed by emergent plant species (26%), while free-floating were represented by 3% and rooted-floating by 3%. Considering the plant families, Moura Júnior et al. (2015) also found Poaceae, Cyperaceae and Fabaceae as the most representative families in a checklist of aquatic macrophytes carried out for the Northern region of Brazil. These authors also observed an unprecedent richness of Podostemaceae due to their efforts on favorable habitats, a procedure not performed in the present study. Nevertheless, five species of Podostemaceae were observed in stretches of rapids in the Xingu River in the present study, most belonging to the genus *Mourera*, and the species *Mourera fluviatilis* appears in the list of endangered species of flora (Brasil, 2008) (Figure 2).

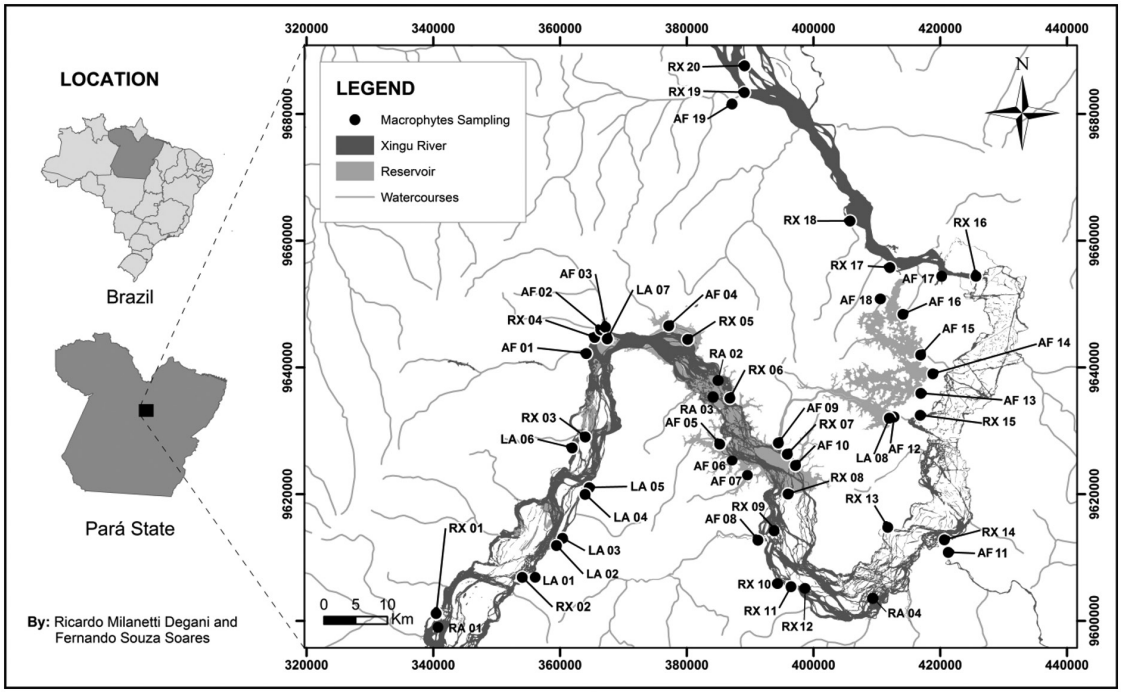

Figure 1. Map of the lower basin of the Xingu River showing the sampling stations of aquatic macrophytes in the period between December 2011 and April 2015.

Table 1. List of families, species, life forms and habitats of aquatic macrophytes in riverine landscapes of the middle Xingu River recorded from October 2014 to July 2015.

Family/Species	Life form	Habitat
Algae		
Charophyceae		
Chara sp.	Rooted submerged	AF
Briophyte		
Ricciaceae		
Ricciocarpos natans (L.) Corda	Free floating	LA
Pteridophyte		
Dennstaedtiaceae		
Pteridium arachnoideum (Kaulf.) Maxon	Amphibious	XR
Thelypteridaceae		
Thelipteris serrata (Cav.) Alston	Emergent	LA, AF
Salviniaceae		
Azolla filiculoides Lam.	Free floating	LA
Salvinia auriculata Aubl.	Free floating	LA, AF
Angiosperm		
Alismataceae		
Echinodorus macrophyllus (Kunth) Micheli subsp. Scaber	Emergent	LA
Amaranthaceae		
Alternanthera brasiliana (L.) Kuntze	Amphibious	LA, XR, AF
Alternanthera tenella Colla	Amphibious	AF
Amaranthus viridis L.	Amphibious	XR
Chamissoa altissima (Jacq.) Kunth	Amphibious	XR
Gomphrena celosioides Mart.	Amphibious	TR
Anacardiaceae		
Tapirira guianensis Aubl.	Amphibious	TR

LA: lagoons; XR: Xingu River; AF: affluents.

Table 1. Continued...

Family/Species	Life form	Habitat
Annonaceae		
Oxandra riedeliana R. E. Fr.	Amphibious	LA
Apocynaceae		
Cynanchum montevidense Spreng.	Amphibious	LA, XR
Rhabdadenia biflora (Jacq.) Müll. Arg.	Amphibious	XR
Araceae		
Montrichardia linifera (Arruda) Schott	Emergent	LA, XR
Pistia stratiotes L.	Free floating	LA, XR
Arecaceae		
Bactris maraja Mart.	Amphibious	LA, XR, TR
Asteraceae		
Acanthospermum australe (Loefl.) Kuntze	Amphibious	XR, AF
Eclypta prostrata (L.) L.	Emergent	LA, XR, AF
Emilia sonchifolia (L.) DC. ex Wight	Amphibious	AF
Mikania cordifolia (L. f.) Wild.	Emergent	LA, XR, AF
Sphagneticola trilobata (L.) Pruski	Amphibious	AF
Trichospira verticillata (L.) S. F. Blake	Amphibious	LA, XR
Wedelia calycina Rich.	Amphibious	LA, XR
Bignoniaceae		
Bignonia sp.	Amphibious	XR
Tanaecium pyramidatum (Rich.) L. G. Lohmann	Amphibious	XR, TR
Boraginaceae		
*Euploca procumbens (*Mill.) Diane & Hilger	Emergent	LA, XR
Heliotropium indicum (L.)	Emergent	LA, XR
Cabombaceae		
Cabomba aquatica Aubl.	Rooted submerged	AF
Commelinaceae		
Commelina bengalensis L.	Amphibious	LA, XR
Cannabaceae		
Trema micrantha (L.) Blume	Amphibious	AF
Convolvulaceae		
Iseia luxurians (Moric.) O'Donnell	Amphibious	LA, XR
Ipomoea setifera Poir	Emergent or Amphibious	XR
Cucurbitaceae		
Luffa operculata (L.) Cogn.	Amphibious	XR, AF
Cyperaceae		
Cyperus aggregatus (Wild.) Endl.	Amphibious	LA
Cyperus articulatus L.	Amphibious	XR
Cyperus digitatus Roxb.	Amphibious	LA, AF
Cyperus distans L.	Amphibious	LA, AF
Cyperus esculentus L.	Amphibious	AF
Cyperus exaltatus Retz.	Amphibious	LA
Cyperus giganteus Vahl	Amphibious	LA, XR
Cyperus iria L.	Amphibious	AF
Cyperus luzulae (L.) Rottb. ex Retz.	Amphibious	LA, XR, AF
Cyperus odoratus L.	Amphibious	LA, XR, AF
Cyperus sphacelatus Rottb.	Amphibious	XR, AF
Cyperus surinamensis Rottb.	Amphibious	LA, XR, AF
Eleocharis interstincta (Vahl) Roem. & Schult.	Amphibious	LA
Eleocharis minima Kunth	Emergent/Amphibious	LA
Fimbristylis dichotoma (L.) Vahl	Amphibious	AF

LA: lagoons; XR: Xingu River; AF: affluents.

Table 1. Continued...

Family/Species	Life form	Habitat
Fimbristylis miliacea (L.) Vahl.	Amphibious	LA, AF
Fuirena umbellata Rottb.	Amphibious	LA, AF
Kyllinga vaginata Lam.	Amphibious	AF
Oxycarium cubense (Poepp. & Kunth) Lye	Emergent	LA, XR, AF
Pycreus aff. polystachyos (Rottb.) P. Beauv.	Amphibious	XR
Pycreus lanceolatus Poir. C.B. Clarke	Amphibious	LA, XR, AF
Rhynchospora nervosa (Vahl) Boeckeler) T. Koyama	Emergent	AF
Scleria gartneri Rad.	Amphibious	XR
Scleria microcarpa Nees ex Kunth	Amphibious	LA
Scleria mitis P.J. Bergius	Amphibious	AF
Scleria secans (L.) Urb.	Amphibious	LA, XR, AF
Euphorbiaceae		
Caperonia castaneifolia (L.) A. St.-Hill.	Emergent	LA, XR, AF
Croton trinitatis Millsp.	Amphibious	LA, AF
Euphorbia hyssopifolia L.	Emergent	XR
Sapium glandulosum (L.) Morong	Emergent	XR, AF
Fabaceae		
Acacia plumosa Martius ex Colla	Amphibious	AF
Aeschynomene brasiliana DC.	Emergent	AF
Calopogonium mucunoides Desv.	Amphibious	AF
Campsiandra angustifolia Spruce ex Benth.	Emergent	XR, AF
Chamaecrista diphylla L. Greene	Amphibious	LA
Chamaecrista nictitans (L.) Moench	Amphibious	XR, AF
Clitoria laurifolia Poir.	Amphibious/epiphyta	LA, XR, AF
Calopogonium mucunoides Desv.	Amphibious	AF
Crotalaria lanceolata E. Mey.	Amphibious	AF
Crotalaria micans Link	Amphibious	AF
Crotalaria palida Aiton	Amphibious	AF
Crotalaria spectabilis Roth	Amphibious	AF
Cymbosema roseum Benth.	Amphibious	XR
Desmodium barbatum (L.) Benth.	Amphibious	AF
Indigofera lespedezioides Kunth	Amphibious	LA, AF
Macrolobium acaciifolium (Benth.) Benth.	Amphibious	XR
Macroptilium gracile (Poepp). ex Willd.	Amphibious	AF
Mimosa pigra L.	Amphibious	XR
Mimosa pudica L.	Emergent	LA, XR, AF
Senna obtusifolia (L.) H.S. Irwin & Barneby	Emergent	AF
Senna reticulata Wild.) H. S. Irwin & Barneby	Amphibious	AF
Sesbania exasperata Kunth	Amphibious	XR
Stylosanthes viscosa (L.) Sw.	Amphibious	AF
Teramnus volubilis Sw.	Amphibious	AF
Vigna lasiocarpa (Mart. Ex Benth.) Verdc.	Amphibious	LA
Vigna longifolia (Benth.) Verdc.	Amphibious	LA
Zornia latifolia Sm.	Amphibious	LA
Gentianaceae		
Coutoubea spicata Aubl.	Amphibious	AF
Hydroleaceae		
Hydrolea spinosa L.	Emergent	LA
Hypericaceae		
Hypericum brasiliense Choisy	Emergent	LA AF
Vismia sp.	Amphibious	XR, AF

LA: lagoons; XR: Xingu River; AF: affluents.

Table 1. Continued...

Family/Species	Life form	Habitat
Lamiaceae		
Cantinoa mutabilis (Rich.) Harley & J.F.B. Pastore	Amphibious	XI, AF
Hyptis atrorubens Poit.	Emergent	LA, XR, AF
Hyptis brevipes Poit.	Emergent	AF
Lindernaceae		
Lindernia crustacea (L.) F. Muell.	Amphibious	LA, XR, AF
Lythraceae		
Cuphea fruticosa Spreng.	Amphibious	XR
Malvaceae		
Byttneria genistella Tr. et. Pl.	Emergent	XR
Hibiscus furcellatus Desr.	Amphibious	LA, XR, AF
Malachra radiata (L.) L.	Emergent	AF
Sida acuta Burm. f.	Amphibious	AF
Sida rhombifolia L.	Amphibious	LA
Sida santaremensis H. Monteiro	Emergent	AF
Urena lobata L.	Emergent	LA, AF
Marantaceae		
Thalia geniculata L.	Emergent	LA
Melastomataceae		
Miconia sp.	Emergent	AF
Rhynchanthera dichotoma (Desr.) DC.	Amphibious	AF
Molluginaceae		
Glinus radiatus (Ruiz & Pav.) Rohrb.	Emergent	XR
Mollugo verticillata L.	Emergent	XR
Myrtaceae		
Myrcia guianensis (Aubl.) DC.	Amphibious	LA
Myrcia splendens (SW.) DC.	Amphibious	AF
Psidium acutangulum DC.	Amphibious	XR
Nymphaeaceae		
Nymphaea amazonum Mart. & Zucc. ssp amazonum	Rooted floating	AF
Nymphaea gardneriana Planch.	Rooted floating	LA, AF
Onagraceae		
Ludwigia affinis (DC.) H. Hara	Amphibious	LA, AF
Ludwigia hyssopifolia (G.Don) Excell	Amphibious	LA, XR, AF
Ludwigia leptocarpa (Nutt.) Hara	Emergent	LA, XR, AF
Ludwigia nervosa (Poir.)	Emergent or Amphibious	AF
Ludwigia octovalvis (Jacq.) P.H. Raven	Amphibious	LA, AF
Oxalidaceae		
Oxalis barrelieri L.	Amphibious	XR
Parkeriaceae		
Ceratopteris pteridoides (Hook.)	Free floating	LA, AF
Phyllanthaceae		
Phyllanthus niruri L.	Amphibious	XR
Piperaceae		
Peperomia pellucida L.	Emergent	LA, XR
Plantaginaceae		
Bacopa rotundifolia (Michx.) Wettst.	Rooted floating	AF
Scoparia dulcis L.	Amphibious	LA, AF
Poaceae		
Acroceras zizanioides (H.B.K.) Dandy	Emergent or Amphibious	LA
Andropogon bicornis L.	Emergent	LA, AF

LA: lagoons; XR: Xingu River; AF: affluents.

Table 1. Continued...

Family/Species	Life form	Habitat
Digitaria ciliaris (Retz.) Koeler	Amphibious	XR
Echinochloa colona (L.) Link	Emergent	XR, AF
Echinochloa crusgalii (L.) P. Beauv.	Emergent	XR, AF
Echinochloa polystachya (H.B.K.) Hitchc.	Amphibious	XR
Eragrostis japonica (Thunb.) Trin.	Amphibious	XR, AF
Homolepsis aturensis (Kunth) Chase	Amphibious	AF
Hymenachne amplexicaulis (Rudge) Nees	Emergent	LA, XR, AF
Luziola subintegra Swallen	Emergent or Amphibious	XR
Megathyrsus massimus (Jacq.) BK Simon & SWL Jacobs	Emergent	XR, AF
Olyra ecaudata Döll.	Amphibious	LA
Oryza glumaepatula Steud.	Emergent	XR
Panicum aquaticum Poir.	Emergent	AF
Panicum dichotomiflorum Michx.	Emergent	AF
Panicum elephantipes Nees ex Trin.	Emergent	AF
Panicum repens L.	Emergent	LA
Paspalum conjugatum P.J. Bergius	Emergent	AF
Paspalum conspersum Schrad.	Emergent	LA, XR, AF
Paspalum repens P. J. Bergius	Emergent	LA, XR, AF
Paspalum virgatum L.	Emergent	LA, XR
Stephostachys mertensii (Roth) Zuloaga & Morrone	Emergent	LA, AF
Podostemaceae		
Castelnavia princeps Tul. &Wedd.	Emergent/rooted submerged	XR
Mourera alcicornis (Tul.) P.Royen	Emergent/rooted submerged	XR
Mourera elegans (Tul.) Baill.	Emergent/rooted submerged	XR
Mourera fluviatilis Aubl.	Emergent/rooted submerged	XR
Tristicha trifaria (Bory ex Willd.) Spreng.	Emergent/rooted submerged	XR
*Weddellina squamulosa*Tul.	Emergent/rooted submerged	XR
Polygalaceae		
Polygala paniculata L.	Emergent or Amphibious	XR
Polygonaceae		
Polygonum acuminatum Kunth	Amphibious	LA
Polygonum punctatum Elliott	Emergent or Amphibious	LA, AF
Polygonum sp.	Emergent	LA, XR, AF
Symmeria paniculata Benth.	Amphibious	AF
Pontederiaceae		
Eichhornia azurea (Sw.) Kunth	Rooted floating	LA, AF
Eichhornia crassipes (Mart.) Solms	Free floating	LA, XR
Eichhornia diversiflora (Vahl) Urb.	Rooted floating	AF
Pontederia subovata (Seub.) Lowden	Rooted floating	LA
Rubiaceae		
Alibertia latifolia (Benth.) K. Schum.	Amphibious	LA
Borreria capitata Ruiz & Pav.	Emergent	XR
Borreria latifolia (Aubl.) K.Schum.	Amphibious	AF
Borreria ocymoides (Burm.f) DC.	Amphibious	LA, AF
Borreria venticillata L.	Amphibious	LA, XR, AF
Diodia kuntzei K. Schum.	Amphibious	LA, XR
Mitracarpus hirtus (L.) DC.	Emergent	XR
Oldenlandia tenuis (K. Schum.) DC.	Amphibious	AF
Sipanea pratensis Aubl.	Amphibious	LA, XR, AF
Staelia reflexa DC.	Amphibious	XR

LA: lagoons; XR: Xingu River; AF: affluents.

Table 1. Continued...

Family/Species	Life form	Habitat
Rutaceae		
Esenbeckia grandiflora Mart.	Amphibious	XR
Sapindaceae		
Cupania latifolia Kunth.	Amphibious	AF
Paullinia pinnata L.	Amphibious	XR, AF
Solanaceae		
Physalis angulata L.	Amphibious	XR
Solanum crinitum Lam.	Amphibious	AF
Solanum jamaicense Mill.	Amphibious	XR, AF
Solanum viarum Dunal	Amphibious	AF
Turneraceae		
Piriqueta cistoides (L.) Griseb.	Amphibious	LA, XR
Piriqueta cistoides subsp. caroliniana (Walt.) Arbo	Amphibious	XR
Verbanaceae		
Lantana canescens Kunth	Amphibious	LA
Stachytharpeta angustifolia (Mill.) Vahl.	Amphibious	LA, AF
Vitaceae		
Cissus erosa Rich.	Amphibious	LA, XR, AF

LA: lagoons; XR: Xingu River; AF: affluents.

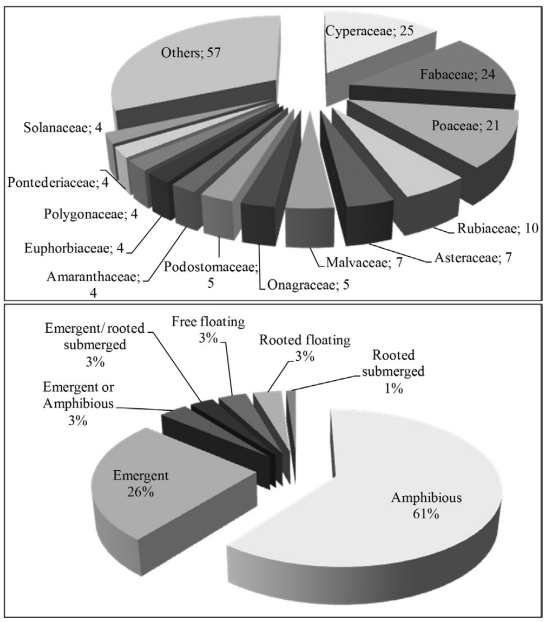

Figure 2. Life forms and proportion of families of aquatic macrophytes in the riverine landscapes of the Xingu River.

3. Results

Table 1 shows the additional list of species of macrophytes found in the lower basin of the Xingu River.

4. Discussion

Although the number of species observed in the present study was higher than that observed by Medeiros et al. (2015), who registered 106 species over two years of monitoring, the proportion of life forms was similar. The high number of amphibian species observed in this study is due to greater efforts directed to the characterization of plants living in the fllodplains and in the parafluvial zone of the Xingu River and tributaries. These results show the importance of these areas as habitats for aquatic macrophytes in the Xingu River basin.

Acknowledgements

The authors wish to express their thanks to Norte Energia S. A. for support and funding of the project, and Lisbeth Podanoschi Faria and Haren Santos for helping during the field campaigns.

References

Brasil. Ministério do Meio Ambiente – MMA, 2008. *Instrução Normativa no 06, de 23 de setembro de 2008*. Diário Oficial da República Federativa do Brasil, Brasília, 55 p.

BUCK, WR. and GOFFINET, B. 2000. Morphology and classification of mosses. In Shaw, JA. and Goffinet, B. (Eds.). *Bryophyte Biology*. Cambridge: Cambridge University Press. p. 72-124. http://dx.doi.org/10.1017/CBO9781139171304.004.

MEDEIROS, GR., RODRIGUES-FILHO, JL., MATSUMURA-TUNDISI, T., TUNDISI, JEM., ABE, DS, OLIVEIRA, HA., DEGANI, RM., BLANCO, FP., FARIA, CRL., CAMPANELLI, L., SOARES, FS., SIDAGIS-GALLI, C., TEIXEIRA-SILVA, V., GATTI-JUNIOR, P. and TUNDISI, JG. 2015. Occurrence of Macrophytes species in the lower basin of the Xingu River. *Brazilian Journal of Biology*. In press.

MOURA JÚNIOR, EG., PAIVA, RMS., FERREIRA, AC., PACOPAHYBA, LD., TAVARES, AS., FERREIRA, FA. and POTT, A., 2015. Updated checklist of aquatic macrophytes from

Northern Brazil. *Acta Amazonica*, vol. 45, no. 2, p. 111-132. http://dx.doi.org/10.1590/1809-4392201402662.

Reflora, 2015. *Lista de espécies da flora do Brasil*. Rio de Janeiro: Jardim Botânico do Rio de Janeiro. Available from:<http://floradobrasil.jbrj.gov.br/>. Access in: 20 July 2015.

SMITH, AR., PRYER, KM., SCHUETTPELZ, E., KORALL, P., SCHNEIDER, H. and WOLF, PG., 2006. A classification for extant ferns. *Taxon*, vol. 55, no. 3, p. 705-731. http://dx.doi.org/10.2307/25065646.

The Angiosperm Phylogeny Group – APG III, 2009. An update of the Angiosperm Phylkogeny Group classification for the orders and families of flowering plants: APG III. *Botanical Journal of the Linnean Society*, vol. 161, no. 2, p. 105-121. http://dx.doi.org/10.1111/j.1095-8339.2009.00996.x.