

Introduction

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Introduction

A *nacardiaceae* are a moderately sized family of c. 800 species belonging to 81 currently recognized genera (PELL et al., 2011). Widely known for economically important plants such as cashew nuts and mangos, the family is most diverse in humid tropical regions, especially in Asia, South America and Africa, although some members occur in temperate areas. *Anacardiaceae* are also well represented in Madagascar, where 14 native genera and an estimated total of 94 species are found (MADAGASCAR CATALOGUE, 2017). The family was treated in the *Flore de Madagascar et des Comores* by PERRIER DE LA BATHIE (1946; see also PERRIER DE LA BATHIE, 1944), who recognized a total of just 38 species in 13 genera. This remained the only available treatment for more than five decades until the first author began a series of investigations aimed at updating the taxonomy of the entire family in Madagascar. Since then the amount of available herbarium material has grown tremendously, primarily through the efforts of Madagascar's *Service Forestier* during the 1960s and 70s, and more recently from field work carried out by staff of the Missouri Botanical Garden and other research institutions starting in the 1970s. This has provided the basis for recent revisions of several genera, including *Campnosperma* Thwaites (RANDRIANASOLO & MILLER, 1998), *Micronychia* Oliv. (RANDRIANASOLO, 2000; RANDRIANASOLO & LOWRY, 2009), and *Operculicarya* H. Perrier (RANDRIANASOLO & LOWRY, 2006), along with the description of one new genus, *Poupartiopsis* Capuron ex J.D. Mitch. & Daly (MITCHELL et al., 2006) and new species in several genera, viz. *Campnosperma* (RANDRIANASOLO & LOWRY, 2004), *Operculicarya* (RANDRIANASOLO & LOWRY, 2015), *Poupartia* Comm. ex Juss. (RANDRIANASOLO & MILLER, 1999), and *Spondias* L. (MITCHELL et al., 2012).

Among the genera of *Anacardiaceae* present in Madagascar that remain to be revised, the largest comprises species long referred to the genus *Protorhus* Engl. This genus, described 135 years ago (ENGLER, 1881), was originally circumscribed to include eight species, one of which, *P. longifolia* (Bernh.) Engl., occurs in southern Africa and the remainder in Madagascar. Several decades later a second African species, *P. namaquensis* Sprague, was added (SPRAGUE, 1913) but was later transferred to *Ozoroa* Delile by VON TEICHMAN & VAN WYK (1994). PERRIER DE LA BATHIE (1944, 1946) described 8 new species from Madagascar, bringing the total number for the island to 15, and more recently RANDRIANASOLO (1998) recognized a total of 19 Malagasy species.

While Madagascar has been regarded as the center of diversity of *Protorhus* (VON TEICHMAN, 1991a, 1991b; VON TEICHMAN & VAN WYK, 1994, 1996; RANDRIANASOLO, 1998), questions have been raised regarding whether the single African species should be treated as belonging to the same genus as the species present in Madagascar (VON TEICHMAN, 1991a, 1991b; RANDRIANASOLO, 1998; PELL, 2004). Several striking morphological differences distinguish the taxa from these two areas, especially fruit characters. In particular, Malagasy *Protorhus* have ellipsoidal, symmetrical fruits with ruminant seeds and inseparable cotyledons (with the exception of one species), whereas the fruits of *P. longifolia* are ovoid to oblong and distinctly asymmetrical, with non-ruminant seeds and separable cotyledons. In a recent molecular phylogenetic study, PELL et al. (2008) tested the monophyly of *Protorhus* and confirmed that the genus, as historically circumscribed, indeed comprises two distinct clades, one containing all 11 taxa from Mada-

gascar included in their sample, which is sister to *Heeria argentea* (Thunb.) Meisn. and *Micronychia macrophylla* H. Perrier (the only representatives sampled of these genera of 1 and 10 species, respectively), and another in which *Protorhus longifolia* from Africa is sister to the tropical African species *Ozoroa insignis* Delile, the only sampled member of this genus of c. 40 species (KOKWARO, 1986).

While ENGLER (1881) did not indicate a type when he described *Protorhus*, 70 years later PHILLIPS (1951) designated *P. longifolia* as the lectotype. In light of the results of the molecular phylogenetic work of PELL et al. (2008), *Protorhus*, as previously circumscribed, is polyphyletic and the name thus cannot be applied to the Malagasy species. As no other generic name is available for the members of the clade comprising species in Madagascar, it must therefore be recognized as a new genus. In the present study we formally describe *Abrahamia* Randrian. & Lowry to accommodate these species and provide a comprehensive taxonomic revision in which a total of 34 species are recognized, 19 of which are newly described. We also discuss additional morphological characters that, in combination, can be used to distinguish between the Malagasy taxa assigned to *Abrahamia* and *Protorhus*, which is henceforth restricted to a single African species.

Materials and methods

Herbarium studies and data management

The taxonomic revision of *Abrahamia* presented here is based on two phases of herbarium studies, conducted prior to and after field work. The first phase involved the examination of herbarium specimens available at the Missouri Botanical Garden herbarium (MO) and received on loan from other institutions with important holdings from Madagascar (in particular G, K, and P; acronyms according to INDEX HERBARIORUM, 2017). The goal of this phase was to identify and delimit those species for which adequate material was available and to identify gaps and/or problems that would require field work to generate additional specimens and make further observations. The second phase, which took place following field work (see below), was aimed at carrying out more detailed morphological analyses that incorporated newly collected material as well as observations made both in the field and through the consultation of herbarium specimens deposited at the two main herbaria in Madagascar, TAN and TEF. This work provided a robust basis for re-assessing species limits, including the delimitation of new species and the preparation of detailed descriptions and an identification key. The terminology used follows HICKEY (1973), RADFORD et al. (1974), WEBERLING (1989), HARRIS & HARRIS (1994), and ELLIS et al. (2009).

Data on all collections examined during this study were captured in TROPICOS (2017) and are available on-line, along with distribution maps, photos of selected species, and other information, through the MADAGASCAR CATALOGUE (2017). For collections lacking geo-coordinates, these were assigned, when possible, using the on-line gazetteer of Malagasy place names (SCHATZ & LESCOT, 2003) and are indicated in square brackets in the specimens cited under each species. Distribution maps were generated from the data in TROPICOS (2017) projected on a base map of the bioclimatic zones of Madagascar (after CORNET, 1974; see SCHATZ, 2000).