

Robert Brown's contributions to Rhamnaceae systematics

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Abstract

Kellermann, Jürgen (School of Botany, The University of Melbourne, Vic 3010, Australia. Email: j.kellermann@pgrad.unimelb.edu.au) 2004. Robert Brown's contributions to Rhamnaceae systematics. *Telopea* 10(2): 515–524. This paper outlines the taxonomic history of Rhamnaceae Juss. during the first half of the 19th century, with a focus on Robert Brown's contributions. Brown advanced Rhamnaceae systematics in two ways. Firstly, he collected 31 species of the family during his time in Australia (1801–1805); nearly all of them were new to science. Although he did not publish any taxa from these collections himself, they were instrumental for his second contribution. In 1814, Robert Brown gave the family a definition that is still valid today. Brown split Rhamnaceae sensu Juss. into Celastraceae R.Br. and Rhamnaceae s.str. (i.e. sensu R.Br.). Some remaining genera had to be dispersed into a number of other families, such as Aquifoliaceae, Oleaceae or Staphyleaceae.

Introduction

The Rhamnaceae Juss. is a medium sized plant family, with 900–1000 species worldwide. The taxon was established by Michel Adanson in the *Familles des plantes* as 'Ziziphi' (Adanson 1763), followed by Antoine-Laurent de Jussieu, who treated it as 'Rhamni' in his *Genera plantarum* (Jussieu 1789). Both authors included a variety of genera in their treatments, many of which are now attributed to other families, for example Celastraceae R.Br., Oleaceae Hoffsgg. & Link or Staphyleaceae Martinov (see Table 2 for a detailed analysis of Jussieu's genera). Jussieu seems also to have had doubts about the uniformity of his 'Rhamni' (Harms 1953), since he asks himself: "An indè dividendus ordo?" (Jussieu 1789: 383). After recent molecular systematic analyses (Fay et al. 2001; Richardson et al. 2000a, 2001), the family now contains 52 genera in eleven tribes (Richardson et al. 2000b; Diego Medan, pers. comm., 2002).

In Australia there are currently about 200 species recognised in 21 genera. There is a high level of endemism with approximately 90% of Australian species occurring only on the continent. The Australian members of the family can be divided into four groups, which represent specific biogeographic elements of the family in Australia (Bentham 1863b; Kellermann 2002; Fig. 1):

Pantropical element - The first group contains c. 18 species in 11 sub-tropical and tropical genera (*Colubrina* Rich. ex Brongn., *Dallachya* F.Muell., *Emmenosperma* F.Muell., *Gouania* Jacq., *Hovenia* Thunb., *Noltea* Rchb., *Rhamnus* L., *Sageretia* Brongn., *Schistocarpaea* F.Muell., *Ventilago* Gaertn., *Ziziphus* Mill.). Three of these genera, *Hovenia*, *Noltea* and *Rhamnus*, are introduced and naturalised in temperate and sub-tropical regions of Australia.

Pacific element - The second group consists of *Alphitonia* Reissek ex Endl., a genus of tropical and sub-tropical trees, which extends from the Malay Archipelago, New Guinea and Australia into the Pacific, as far as Hawaii. Its closest relative is the monotypic genus *Granitites* Rye from granite outcrops in Western Australia (Fay et al. 2001; Kellermann 2002). Fay et al. (2001) assume that *Granitites* is a relict of the

rainforest flora that dominated Western Australia in the Cretaceous/Tertiary, resulting in the disjunct distribution of the two genera.

Endemic element - The third group is composed of five species-rich genera with a high level of endemism in southern, temperate to semi-arid regions of Australia, namely *Cryptandra* Sm. (30-35 spp.), *Pomaderris* Labill. (65 spp. in Australia and 8 spp. in New Zealand), *Spyridium* Fenzl (c. 35 spp.), *Stenanthemum* Reissek (25–30 spp.) and *Trymalium* Fenzl (c. 15 spp.). These five genera form, together with *Blackallia* C.A.Gardner (2 spp.) and *Siegfriedia* C.A.Gardner (1 sp.), the tribe *Pomadereae* Reiss. ex Endl. The presence of stellate hairs is a feature that distinguishes this tribe from all other Rhamnaceae species (Kellermann 2001; Richardson et al. 2000b; Suessenguth 1953).

Gondwanan element - The fourth group of Australian Rhamnaceae comprises one genus, *Discaria* Hook., with two species restricted to the mountainous regions of south-eastern Australia and Tasmania, one species in New Zealand, and five species in South America (Tortosa 1983). This genus has a Gondwanan distribution.

Robert Brown in Australia

Under the captaincy of Matthew Flinders, Robert Brown as the naturalist aboard H.M.S. *Investigator*, circumnavigated Australia from 1801 to 1803. When Flinders sailed for England to seek a replacement for the unseaworthy *Investigator*, Brown and Ferdinand Bauer, the botanical artist of the voyage, stayed for another two years in Australia to collect plant specimens and to explore the flora and fauna of the continent. During this time, Brown travelled extensively in the Sydney region, and also to Port Phillip and Tasmania, where he lived for some months. A detailed itinerary of the voyage and a summary of Brown's collection sites are given in Chapman et al. (2001) and Vallance et al. (2001).

When Brown arrived in Australia in December 1801, no Rhamnaceae species had been described from the continent. Two widespread tropical species, which occurred in Northern Australia, *Colubrina asiatica* (L.) Brongn. and *Ziziphus oenoplia* (L.) Mill., were already known. James Edward Smith had given a generic description of *Cryptandra* (Smith 1798), however, he delayed the enumeration and description of species until 1808, with *Cryptandra ericoides* Sm. being the first species described for this genus (Smith 1808).

Brown collected 31 species of Rhamnaceae during his time in Australia from 1801 to 1805, most of them along the south and east coast (Fig. 1; Table 1; an annotated list of his Rhamnaceae collections is in preparation). He gathered 26 species from the endemic tribe *Pomadereae*, mainly from the genera *Pomaderris*, *Spyridium*, and *Trymalium*, which frequently occur along the coast. Three *Cryptandra* species were found by him during inland trips around Sydney. One species of *Discaria* was collected by Brown in Tasmania. In Northern Australia he found species of *Ziziphus* and *Colubrina*, as well as two species of the genus *Alphitonia*. Thus Robert Brown collected a representative sample of Rhamnaceae species and managed to acquire members of all four biogeographic groups of the family in Australia.

By the time he returned to England, five Australian species had been published by Jacques Julien Houton de Labillardière and Pierre Ventenat (Dryander 1806). Some of the remaining 24 species in Brown's collections had been collected previously on Cook's voyages, but none of them was described or published.

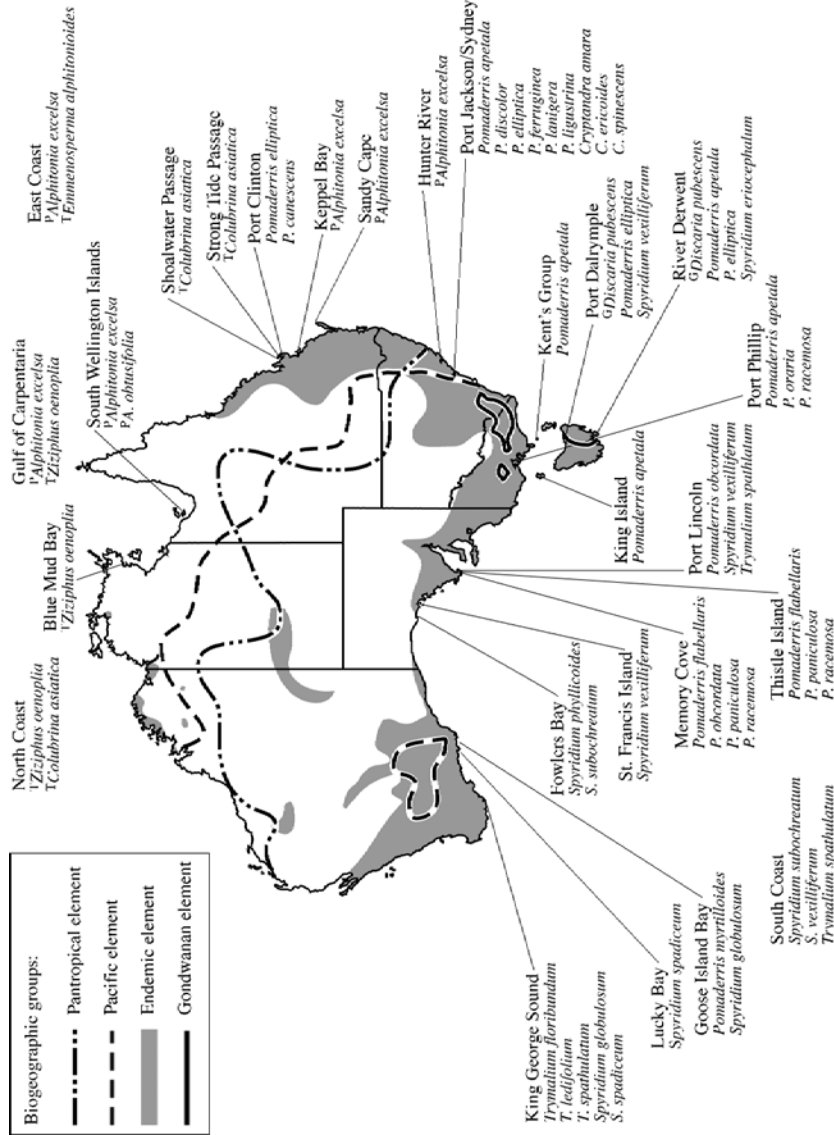


Fig. 1. The distribution of Rhamnaceae in Australia, and Robert Brown's Rhamnaceae collections from 1801–1805. The biogeographic regions for Australian Rhamnaceae (Bentham 1863b; Kellermann 2002) are as described in the text. Species names without superscript symbol belong to the Endemic element; ^G Gondwanan element; ^T Pantropical element; ^P Pacific element. Only locations where Brown collected Rhamnaceae are indicated. Some of his collections only carry approximate locations such as South, East and North Coast, or Gulf of Carpentaria. Data from Bentham (1863b); Moore et al. (2001); BRI, DNA, CANB, MEL, NSW & PERTH.

The natural system

Robert Brown readily accepted Jussieu's (1789) and later Augustin-Pyramus de Candolle's (1813) natural system (Mabberley 1985). However, when examining his Australian collections he soon realised that Jussieu's classification was not sufficient to accommodate the new genera and species that he had encountered during his voyage. "In arranging the collection", he stated in a letter to Joseph Banks from Sydney, dated 6 August 1803, "I at first follow'd Jussieu's Ord's Naturalis; but I soon found the plants of doubtful affinity so numerous that I judg'd it better to use the Linnean method" (Vallance et al. 2001: 419). Many of Jussieu's family circumscriptions had to be amended and new families had to be described. "It was Brown's first-hand experience of the inadequacies of both systems that led him by his own observations so much to improve Jussieu's [system]" (Stearn 1960: xxviii).

Brown's publication on Rhamnaceae, and his views on the family

In 1810 Robert Brown published the first volume of his *Prodromus florum Novae Hollandiae et Insulae van-Diemen* (Brown 1810), which dealt with cycads, ferns and fern allies, monocotyledons, and 37 families of dicotyledonous plants. In this book he transferred two genera from Jussieu's Rhamnaceae, *Mayepea* Aublet and *Samara* L., to Oleaceae and Myrsinaceae R.Br., respectively. The fact that *Samara* is allied to *Myrsine* L., and therefore to Brown's family Myrsinaceae, may have been known by botanists for some time, but Brown was the first to publish this information. An annotation by Richard Salisbury in his copy of Brown's *Prodromus* (now held in the library of the Botanic Gardens of Adelaide) states that he was told about the affinity of *Samara* and *Myrsine* by "Dr. [Dryander] in 1806, & long before when Swartz was here [in London, i.e. 1786–1787]" (Barker & Barker 1990: 51). The second volume of the *Prodromus*

Table 1. The Rhamnaceae species collected by Robert Brown in Australia. See Fig. 1 for explanation of symbols and source of data.

^p <i>Alphitonia excelsa</i> (Fenzl.)Benth.	<i>Spyridium eriocephalum</i> Fenzl
^p <i>A. obtusifolia</i> Braid	<i>S. globulosum</i> (Labill.)Benth.
[†] <i>Colubrina asiatica</i> (L.)Brongn.	<i>S. phyllicoides</i> Reissek
<i>Cryptandra amara</i> Sm.	<i>S. spadiceum</i> (Fenzl)Benth.
<i>C. ericoides</i> Sm.	<i>S. subochreatum</i> F.Muell. ex Reissek
<i>C. spinescens</i> Sieber ex DC.	<i>S. vexilliferum</i> (Hook.)Reissek
^o <i>Discaria pubescens</i> (Brongn.)Druce	<i>Trymalium floribundum</i> Steud.
[†] <i>Emmenosperma alphitonioides</i> F.Muell.	<i>T. ledifolium</i> Fenzl
<i>Pomaderris apetala</i> Labill.	<i>T. spathulatum</i> (Labill.)Ostenf.
<i>P. canescens</i> (Benth.)N.A.Wakef.	[†] <i>Ziziphus oenoplia</i> (L.)Mill.
<i>P. discolor</i> (Vent.)Poir.	
<i>P. elliptica</i> Labill.	
<i>P. ferruginea</i> Sieber ex Fenzl	
<i>P. flabellaris</i> (F.Muell. ex Reissek)J.M.Black	
<i>P. lanigera</i> (Andrews)Sims	
<i>P. ligustrina</i> Sieber ex DC.	
<i>P. myrtilloides</i> Fenzl	
<i>P. obcordata</i> Fenzl	
<i>P. oraria</i> F.Muell. ex Reissek	
<i>P. paniculosa</i> F.Muell. ex Reissek	
<i>P. racemosa</i> Hook.	

would have included Brown's treatment of Rhamnaceae and the description of his new species from Australia. Unfortunately, this second volume was never published.

As such, his *General remarks, geographical and systematical, on the botany of Terra Australis*, published in 1814 in the appendix of Matthew Flinders' *A voyage to Terra Australis* (Brown 1814), is the only publication where he expressed his opinion about many of the families not dealt with in his *Prodromus*, including Rhamnaceae. Robert Brown divided the Rhamnaceae of Jussieu into three groups (Grès 1901; Table 2):

(1) The "greater part of the first two sections of the Rhamni of Jussieu" (Brown 1814: 554) formed the newly established family Celastraceae ('Celastrinae' of Brown), which he mainly distinguished from the Rhamnaceae by having flowers with imbricate aestivation of the calyx, and stamens that alternate with the petals.

(2) The third and fourth section of Jussieu's Rhamnaceae, i.e. the genera *Rhamnus*, *Paliurus*, *Ziziphus*, *Ceanothus*, *Colletia*, *Hovenia* and *Phyllica*, and the genus *Gouania* from section VI made up the redefined family Rhamnaceae ('Rhamneae' of Brown). He also included three genera that had been described after Jussieu, namely *Cryptandra*, *Pomaderris* and *Ventilago*. Robert Brown's detailed definition of the family is reproduced in Figure 2.

RHAMNEÆ. Into this order I admit such genera only as have ovarium cohering more or less with the tube of the calyx, of which the laciniae have a valvular aestivation; stamina equal in number to these laciniae, and alternating with them; an ovarium with two or three cells and a single erect ovulum in each; an erect embryo generally placed in the axis of a fleshy albumen, or entirely without albumen; the petals, which are opposite to the stamina, and inclose the antherae in their concave laminæ, are in some cases wanting.

With these characters *Rhamnus*, *Ziziphus*, *Paliurus*, *Ceanothus* (from which *Pomaderris* is hardly distinct), *Colletia*, *Cryptandra*, *Phyllica*, *Gouania*, *Ventilago*, and probably *Hovenia* correspond. In comparing this description of Rhamneæ with that of *Buttneriaceæ* formerly given, they will be found to coincide in so many important points, that the near relationship of these two orders cannot be doubted, and thus an unexpected affinity seems to be proved between Rhamneæ and *Malvaceæ*.

In *Terra Australis* upward of thirty species of Rhamneæ belonging to *Ziziphus*, *Ceanothus*, *Pomaderris*, *Colletia* and *Cryptandra*, have been observed, and chiefly in its principal parallel or southern regions.

Fig. 2. Robert Brown's definition of Rhamnaceae from his *General remarks, geographical and systematical, on the botany of Terra Australis* (1814). Reproduced from Bennett (1866-1868), vol. 1, p. 26, with permission of the library of the National Herbarium of Victoria (MEL).

(3) The last two sections of Jussieu contained a mixture of genera, which had to be dispersed into a number of different families.

Robert Brown did not state in his *General remarks* nor in any of his published treatises which genera he included in Celastraceae (for collections of his works see Nees von Esenbeck 1825–1834, Bennett 1866–1868). He also gave no indication about the placement of the remaining genera of Jussieu into other families. The only exception was his placement of *Brunia* Lam. in its own family, Bruniaceae Bercht. & J.Presl., in Clarke Abel's *Narrative of a journey in the interior of China* (Brown 1818b).

Since Brown was one of the most influential botanists of his time, he was frequently consulted by others. Table 2 summarises the development of Rhamnaceae classification in Brown's time, from Jussieu (1789) to Endlicher (1836–1840). Brown knew most of the botanists listed in this table and was indeed friends with some of them. Candolle "pestered Brown with questions on the families he was working on for his *Systema* and, later, his *Prodromus*" (Mabberley 1985: 210). Adolphe Théodore Brongniart visited Brown in London during the preparation of his treatment of Rhamnaceae. In the preface to his *Memoire sur la famille des Rhamnées*, the first systematic monograph written on the family, Brongniart expressed his gratitude towards Brown for being allowed access to his herbarium (Brongniart 1826). As such, the treatments of Candolle (1825) and Brongniart (1826) in particular, were most likely written in consultation with Brown. Brown was a friend of Friedrich Wilhelm Heinrich Alexander von Humboldt, and also knew Aimé Jaques Alexandre Bonpland, Karl Siegismund Kunth, Heinrich Gottlieb Ludwig Reichenbach, as well as many other European botanists (Mabberley 1985). It might therefore be appropriate to assume that the data presented in Table 2 also represent Robert Brown's view on Rhamnaceae and Celastraceae.

It is apparent (Table 2) that nearly all genera that Brown, Candolle and Brongniart excluded from Jussieu's Rhamni are still placed in the families to which they were transferred by these authors. The genera included by Brown in the redefined Rhamnaceae are still part of that family. In fact, the definition of Rhamnaceae given by Brown was accepted in all subsequent major treatments of the family (e.g. Reissek 1840, Hooker 1862, Baillon 1875, Weberbauer 1895, and Suessenguth 1953) and is still valid today (e.g. Cronquist 1981, Jones 1993, Mabberley 1997, and Richardson 2000b). Some 19th century German and French authors (e.g. Baillon 1875, 1891, Bischoff 1840) even referred to the family as having been established by Robert Brown.

Species named by Brown, or from his collections

Robert Brown did not publish from any of his Australian Rhamnaceae collections. There are only two species of Rhamnaceae connected with his name:

Rhamnus inebrians R.Br. (*nomen nudum*), which was published without description in James H. Tuckey's *Narrative of an expedition to explore the River Zaire*, in a list of plants collected near the Congo River by Christian Smith (Brown 1818a).

Cryptandra pyramidalis R.Br. ex Brongn., a species Brown communicated to Brongniart (1826) presumably from his own collections at the Nepean River and Port Jackson. This is now a synonym of the earlier *Cryptandra spinescens* Sieber ex DC. (Candolle 1825).

Brown's collections were not readily open to other botanists until the 1880's, with the exception of George Bentham (Mabberley 1985; Bentham 1863a), who was given access to them during the preparation of *Flora Australiensis* (Bentham & Mueller 1863–1878). As a result, no other Australian Rhamnaceae species were described from Robert Brown material in the 19th century. In 1925 Kenneth William Braid used Brown

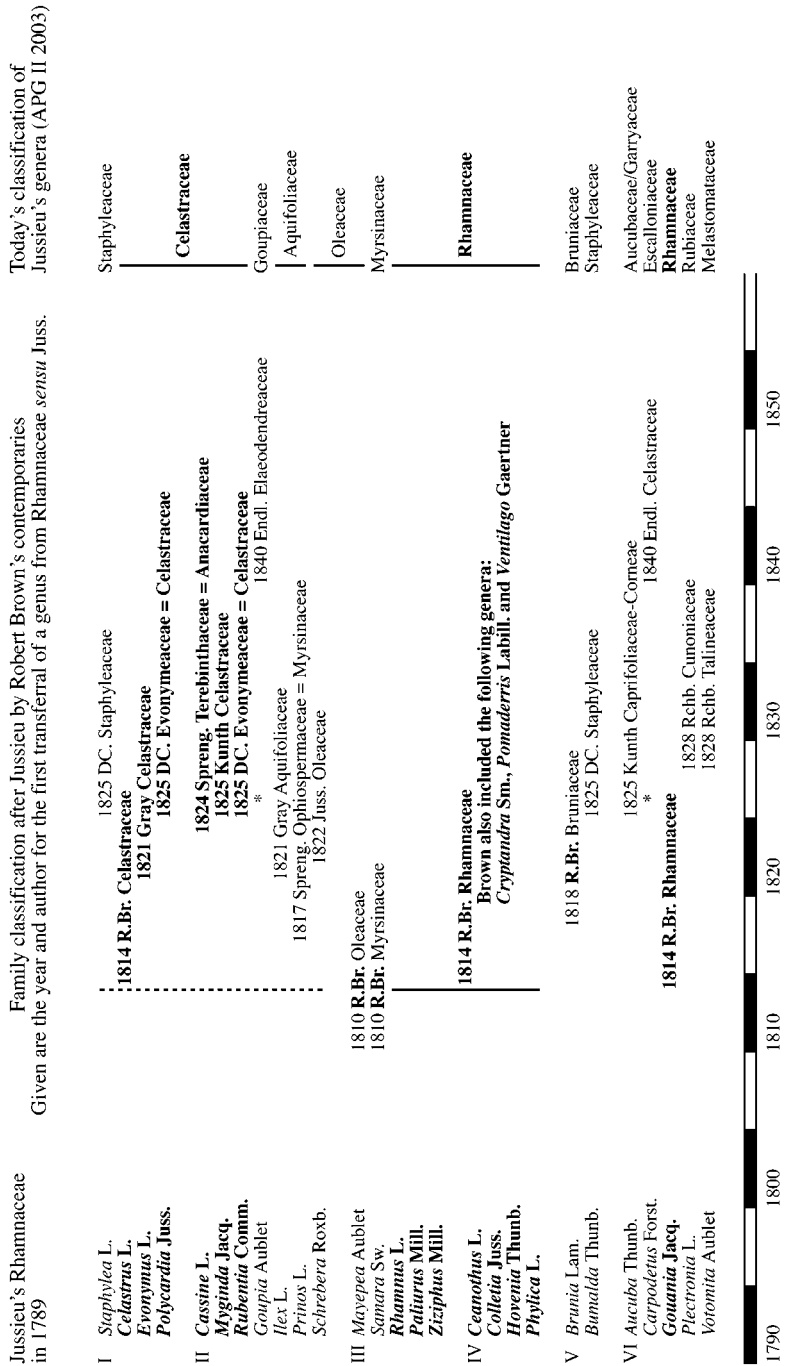


Table 2. The development of Rhamnaceae classification from 1789-1840, compared with today. Genera of Rhamnaceae and Celastraceae are highlighted in bold print. Data from Bennett (1866-1868), Brown (1810), Farr and Zijlstra (1996-2003), Lindley (1846), Mabberley (1993) and Pfeiffer (1873-1874). Brongniart (1826) transferred two genera out of Jussieu's Rhamnaceae without mentioning a new family placement (indicated by an asterisk '*').

specimens to describe *Alphitonia obtusifolia* Braid, using Brown's manuscript name *Ceanothoides obtusifolia* (Braid 1925). Eduard Fenzl described six Australian species (*Pomaderris phyllirifolia*, *P. myrtilloides*, *P. obcordata*, *Spyridium eriocephalum*, *Trymalium majoranifolium*, *Ziziphus pomaderroides*) from material Ferdinand Bauer gathered during the voyage on the *Investigator* (Fenzl 1837). Whether some of these collections were indeed collected by Bauer and Brown together, and whether some of these collections are also present in Robert Brown's herbarium remains to be seen.

Conclusion

Robert Brown revolutionised the family concept of Rhamnaceae. He proposed a new definition of the family that is still valid today. Brown's Australian collections played a crucial role in his reassessment of the family concepts of Jussieu. For Rhamnaceae, he mainly gathered specimens of the endemic tribe *Pomadereae*, nearly all of which were new to science. Although he did not publish names for any of his Rhamnaceae collections, we can assume that these collections, as well as Brown's own field observations on the family during his stay in Australia, would have been quite important for the development of his new definition of the family Rhamnaceae.

Acknowledgments

I thank Eric Groves (BM), Paul Robins (BRI), Andrea Hope (DNA), Peter Neish & Neville Walsh (MEL), Barry Conn (NSW), Alex Chapman & Barbara Rye (PERTH) for their assistance in collecting information about Robert Brown specimens. Gill Brown provided help and hospitality at CANB. Diego Medan (Buenos Aires, Argentina) gave advice on the currently accepted genera in the family Rhamnaceae. Helen Hewson, Pauline Ladiges, Gareth Nelson, Frank Udovicic, and Llywela Williams read drafts of the manuscript. Free access to FloraBase by PERTH and CALM, W.A., is acknowledged. This Ph.D. project is funded by University of Melbourne scholarships (MIRS, MIFRS, Sophie Ducker Postgraduate Scholarship), a Melbourne University Research Development Grant and the Australian Systematic Botany Society (Hansjörg Eichler Grant).

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Manuscript received 1 July 2002

Manuscript accepted 26 September 2003