



# *Diodia kuntzei* K. Schum (Rubiaceae, Spermaceae): a new record for the state of Acre, Brazil

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## Abstract

*Diodia kuntzei* (Rubiaceae, Spermaceae) is prostrate herb, rooting at the nodes, with reddish stems, multifimbriate stipules, axillary one-two-flowered inflorescences, corolla with filiform tube, and indehiscent fruit. The species is recorded for the first time for the state of Acre, where it was found in Alto Juruá region, municipality of Cruzeiro do Sul, in waterlogged habitat (07°33'32"S, 072°42'59"W). Images of the plant and comments on its habitat and distribution are provided.

## Keywords

Alto Juruá, flora, geographic distribution, taxonomy.

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## Introduction

Rubiaceae is a well-represented family in the Amazonian state of Acre. Daly and Silveira (2008) reported 61 genera and 242 species, of which *Psychotria* L. (58 spp.), *Palicourea* Aubl. (21), *Coussarea* Aubl. (20), and *Faramea* Aubl. (18) are the richest taxa. The remaining genera have less than 10 species. Such records, however, have changed over the last years, increasing the number of the taxa for the state. Medeiros et al. (2014), as the product of a new floristic study, have added two more genera and 10 species.

Daly and Silveira (2008) mentioned only five genera among the species with herbaceous habit: *Spermace* L. with six species; *Geophila* D. Don with three;

and *Psychotria* L., *Oldenlandia* L., *Sipanea* Aubl., and *Margaritopsis* C.Wright with only one each. According to Daly and Silveira (2008), there were no *Diodia* L. species in Acre. However, they listed two names, *Diodia ocymifolia* (Willd.) Bremek. and *D. hyssopifolia* (Willd.) Cham. & Schult., as synonyms of *Spermace ocymifolia* Willd. and *S. hyssopifolia* Willd., respectively. In contrast, Medeiros et al. (2014) listed those names under *Borreria ocymifolia* (Willd.) Bacigalupo & E.L.Cabral and *Borreria hyssopifolia* (Willd.) Bacigalupo & E.L.Cabral, respectively.

*Diodia*, as described by Linnaeus in 1753, is a genus native to the Americas, based on *D. virginiana* L. from

the USA. It is composed of herbs with axillary inflorescences, four- or five-lobed corolla with a long slender tube, and indehiscent fruits; they are usually associated with palustrine habitats. The only taxonomic revision for the genus was published by Bacigalupo and Cabral (1999), in which five species were accepted, of which three occur in Brazil. However, these authors listed a only few specimens from some states, which reflects the need to increase the number of field collections and exhaustive work in regional herbaria. *Diodia kuntzei* K.Schum. is a widely distributed species in South America and was recorded for Venezuela, Peru, Bolivia, Brazil, Argentina, and Paraguay (Bacigalupo and Cabral 1999; Pereira 2007). In Brazil, based on available online databases (SpeciesLink 2019; Flora do Brazil 2019), this species grows in the states of Pará, Rondônia, Amazonas, Amapá, Mato Grosso, Goiás, Mato Grosso do Sul, Paraná, Minas Gerais, and Tocantins. In the present paper, we report *Diodia kuntzei* for the first time from the state of Acre in the western Brazil, in the Alto Juruá region.

## Methods

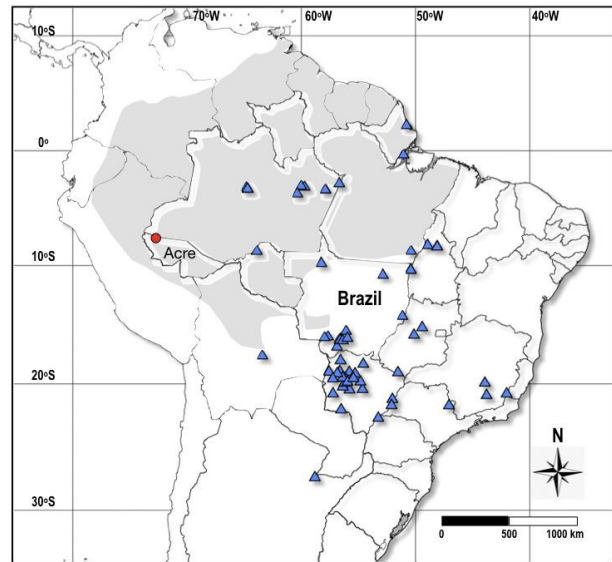
Conventional taxonomic techniques were followed. The specimens studied were collected in the natural areas of the Campus Floresta of the Federal University of Acre, municipality of Cruzeiro do Sul, in seasonally waterlogged open areas of flat relief (07°33'32"S, 072°42'59"W; altitude ca 240 m). The identification was made using the last taxonomic treatment (Bacigalupo and Cabral 1999) and by comparison with images available via SpeciesLink (2019) and Flora do Brazil (2019). The specimens were deposited in the Campus Floresta Herbarium (CFCZS) of the Federal University of Acre. The herbaria acronyms follow the standards of Holmgreen et al. (1990). To check the records of species geographic distribution we use data from REFLORA database among others (Bacigalupo and Cabral 1999; Zappi and Lima 2016; SpeciesLink 2019; Flora do Brazil 2019).

## Results

***Diodia kuntzei* K.Schum.**, in Mart., Fl. Bras. 6(6): 15. 1888. "Lectotype: Paraguay, Asuncion, Habitat ad ripas fluvii: Paraguay, prope Assumption, Mar 1875, B. Balansa 1750 (P not seen, designated by Bacigalupo and Cabral 1999; isolectotypes BAF!, F!, P not seen, K!)".

**New record.** Brazil: Acre: Alto Juruá region: Cruzeiro do Sul: Universidade Federal do Acre: *Campus Floresta* (Fig. 1), in open, flat relief, and seasonally waterlogged areas (07°33'32"S, 072°42'59"W), Silva, C.P., 27 Dec. 2017 (18, CFCZS 603) (Fig. 2A–D); Souza, M.C., 15 Feb. 2018 (781, CFCZS 723).

**Additional specimens examined (Table 1).** BRAZIL • Amapá: between km 25 of BR 156 and Matapi, NW of Macapá, 16 Feb. 1979, Austin 7422 (INPA 97442). •



**Figure 1.** Geographic distribution of *Diodia kuntzei* in South America, and the Amazon Rain Forest distribution (light shaded), based on literature, REFLORA, and SpeciesLink records (blue triangles). The red circle indicates the new record from the state of Acre.



**Figure 2.** *Diodia kuntzei* **A.** Habit and details of margins and reddish veins of leaves. **B, C.** Details of inflorescence: flowers with pilose lobes and exerted stamens.

Amazonas: Careiro, Rio Solimões, South bank, 10 km E of Boca de Janaucá, 3 Oct. 1973, Berg, C.C. 17589.0 (NY1061132). • Amazonas: Boca do paraná do Cambixe,

**Table 1.** Records of collections of the *Diodia kuntzei* in South America, included Figure 1. \*New records.

Brazil state/country	Collection code	Collector no.	Latitude	Longitude	Brazil state/country	Collection code	Collector no.	Latitude	Longitude
Acre*	CFCZS	603/723	-07.5589	-072.7164	Mato Grosso do Sul	UEC	79	-19.535	-055.45
Amapá	UEC	7422	02.2000	-050.8167	Mato Grosso do Sul	UPCB	3144	-18.995	-056.6244
Amapá	IAN	27232	-00.3667	-051.0663	Mato Grosso do Sul	UEC	3817	-18.9833	-056.65
Amapá	HAMAB	1258	-00.3666	-051.0663	Mato Grosso do Sul	COR	596	-19.15	-056.85
Amapá	HAMAB	274	-00.3666	-051.0663	Mato Grosso do Sul	JPB	189	-19.5725	-057.2416
Amapá	HAMAB	192	-00.3666	-051.0663	Mato Grosso do Sul	UB	526	-19.0166	-057.5833
Amazonas	INPA	27	-02.8938	-056.6861	Mato Grosso do Sul	SP	1815	-21.2558	-052.0369
Amazonas	NYBG	13176	-03.4166	-057.9166	Mato Grosso do Sul	MBM	5346	-20.4711	-055.7872
Amazonas	INPA	13176	-03.4166	-057.9166	Mato Grosso do Sul	COR	526	-19.0047	-057.6017
Amazonas	US	13176	-03.42	-057.92	Mato Grosso do Sul	COR	818	-19.0091	-057.6533
Amazonas	NYBG	23295	-03.1771	-059.7191	Mato Grosso do Sul	COR	575	-19.0091	-057.6533
Amazonas	US	12074	-03.37	-064.7	Mato Grosso do Sul	MBM	60935	-19.0091	-057.6533
Amazonas	INPA	12074	-03.3666	-064.7	Mato Grosso do Sul	SPF	900	-19.0091	-057.6533
Amazonas	US	29244	-03.23	-064.83	Mato Grosso do Sul	UPCB	4243	-19.0091	-057.6533
Amazonas	INPA	INPA3617	-03.1019	-060.0250	Mato Grosso do Sul	UEC	2135	-19.0091	-057.6533
Amazonas	INPA	712	-03.1019	-060.0250	Mato Grosso do Sul	CPAP	2236	-18.3666	-054.5833
Amazonas	IAN	3617	-03.1019	-060.0250	Mato Grosso do Sul	CPAP	3620	-19.1616	-055.3
Amazonas	IAN	712	-03.1019	-060.0250	Mato Grosso do Sul	CPAP	2732	-19.0272	-055.8108
Amazonas	INPA	51	-03.7680	-060.3692	Mato Grosso do Sul	CPAP	5346	-19.85	-055.9666
Amazonas	INPA	23295	-03.7680	-060.3692	Mato Grosso do Sul	CPAP	3316	-19.9266	-056.2177
Amazonas	INPA	2977	-03.7680	-060.3692	Mato Grosso do Sul	CPAP	5764	-19.4833	-056.3833
Amazonas	IAN	1609	-03.3541	-064.7114	Mato Grosso do Sul	CPAP	1299	-18.0666	-056.5666
Argentina	IAC	16505	-27.486	-058.8176	Mato Grosso do Sul	CPAP	3144	-18.995	-056.6244
Goiás	UB	294	-15.2981	-049.4267	Mato Grosso do Sul	CPAP	60935	-18.9833	-056.65
Goiás	HUNI	619	-15.9344	-050.1403	Mato Grosso do Sul	CPAP	S/N.	-18.9833	-056.65
Goiás	HUNI	620	-15.9344	-050.1403	Mato Grosso do Sul	CPAP	596	-19.15	-056.85
Mato Grosso	SPF	7077	-14.3333	-051.1666	Mato Grosso do Sul	CPAP	6874	-20.8	-057.2333
Mato Grosso	SPF	7077	-14.3333	-051.1666	Mato Grosso do Sul	CPAP	09	-20.2406	-056.3783
Mato Grosso	US	1026	-19.50	-056.17	Mato Grosso do Sul	CPAP	4243	-19.0091	-057.6533
Mato Grosso	US	181/1-3	-16.40	-056.38	Mato Grosso do Sul	CPAP	526	-19.0091	-057.6533
Mato Grosso	US	2773	-16.93	-056.88	Mato Grosso do Sul	CPAP	683	-19.0091	-057.6533
Mato Grosso	HPAN	3304	-16.1316	-057.9822	Minas Gerais	BHCB	15085	-20.9388	-043.7908
Mato Grosso	CNMT	717	-09.8197	-058.2587	Minas Gerais	UFG	47	-20.8083	-042.0297
Mato Grosso	SP	CRONDON4678	-15.5961	-056.0966	Minas Gerais	BHCB	2501	-19.9207	-043.9378
Mato Grosso	UEC	3322	-16.2567	-056.6227	Paraná	ICN	1650	-22.7722	-053.2668
Mato Grosso	UEC	31	-16.2567	-056.6227	Pará	NYBG	8873	-8.75	-050.42
Mato Grosso	UEC	1058	-16.2567	-056.6227	Rondônia	IAN	14591	-8.7619	-063.9039
Mato Grosso	UEC	891	-16.2567	-056.6227	Bolívia	UB	3559	-17.6669	-063.4280
Mato Grosso	UEC	3509	-16.2567	-056.6227	São Paulo	UEC	176	-21.77	-047.0800
Mato Grosso	UEC	3175	-16.2567	-056.6227	São Paulo	UEC	168	-21.76	-052.1100
Mato Grosso	UEC	2726	-16.2567	-056.6227	Tocantins	HUTO	s.n.	-8.3969	-048.1161
Mato Grosso	UEC	975	-16.2567	-056.6227	Tocantins	HUTO	1969	-8.3969	-048.1161
Mato Grosso	UEC	s.n.	-16.2567	-056.6227	Tocantins	HUTO	s.n.	-8.3691	-048.1202
Mato Grosso	UEC	01	-16.2567	-056.6227	Tocantins	IAN	046	-8.2666	-048.95
Mato Grosso	UEC	2930	-16.2567	-056.6227	Tocantins	IAN	046	-8.2666	-048.95
Mato Grosso	HPAN	987	-16.0706	-057.6789	Tocantins	SP	4009	-10.3963	-050.4302
Mato Grosso	CPAP	3013	-16.3602	-056.6166	Tocantins	US	4009	-10.3964	-050.4303
Mato Grosso	CPAP	1886	-16.3833	-056.65	Tocantins	NYBG	4009	-10.3964	-050.4303

clay soil, 22 Apr. 1976, Araújo, I.J. 2977 (INPA 55908). • Amazonas: Tefé, banks of Lago Tefé, 2 Dec.1982, Plowman 12074 (INPA125823). • Amazonas: Manaus, Cachoeira grande dos Bulhães, firm, sandy, humid soil, 16 Mar. 1956, Almeida, J.C. s/n (INPA 3617). • Amazonas: Parintins, várzea forest, Mamuru riverbank, 27 Jan. 2009, Galvão, A.K.L 27 (INPA 234707). • Amazonas: Paraná Urariá, between rio Maués-Açú and rio Apoquitaua, white water, 25 July 1983, Hill, S.R. 13176 (INPA 128628). • Amazonas: Manaus, praia da fábrica

de gelo, riverbank, 17 Dec. 1958, Rodrigues, W.A. 712 (INPA 6860). • Amazonas: Careiro, lake near Botafogo head office, 4 Apr. 1970, Coelho, L.F. 51 (INPA 27999). • Amazonas: Tefé. Banks of Lago Tefé, 2 Dec. 1982, Plowman, S.N. (INPA 3033315). • Amazonas: Careiro, Fazenda Santa Terezinha, Costa Terra Nova, Ilha do Careiro, Rio Amazonas, 21 Feb.1975, Prance 23295 (NY 1061130). • Amazonas: Manaus-Porto Velho road, stretch between the rivers Castanho and Tupana, clay forest, 17 July 1972, Silva, M.F 835 (INPA 36926). •

Amazonas: s/d, Tsugaru, S. 836 (NY 1061170). • Mato Grosso: Poconé: road to porto cercado, murundum field, seasonally flooded, 28 Sept. 1992, Prado, A.L. 31 (UEC 122529). • Mato Grosso: seasonally floodable field, near km 18 of transpantaneira Poconé road, 3 Oct. 1991, *Berg 17589* (NY 1061132). • Mato Grosso: Poconé: floodable field, farm Tutu Falcão, 4 July 1991, Prado, A. 891 (UEC 122544). • Mato Grosso do Sul: Brasilândia Perus, Territorial São Paulo, 26 Nov. 1992, Catharino 1815 (HUEFS 31433). • Mato Grosso: Poconé: Jofre field, floodable area, dry, 11 Sept. 1991, Prado, A.L. 16 (UEC 122530). • Mato Grosso: Poconé, farm Santa Izabel, seasonally flooded field, 26 Mar 1992, Prado 3175 (UEC122547). • Tocantins: lagoa da Confusão. Ilha do Bananal, National Park of Araguaia, 25 mar. 1999, Mendonça 40090 (NY1067955).

**Identification.** Herbs, prostrate, rooting at the nodes, reddish stems, stipules 3–5 fimbriate, fimbriae pilose, reddish-vinous, ca 2 mm long; sessile leaves, elliptic, 9–17 × 2 mm, margins and midvein reddish-vinous; axillary one-two-flowered inflorescences; calyx 2-lobed, lobes ca 4 mm long, notoriously pilose; corolla white 17 mm long, tube ca 7 mm, 4-lobed, lobes 4 mm long; stamens fixed at the base of the corolla lobes, ca 5 mm long, anthers creamy, ca 1 mm long, style 17 mm long, bifid, stigmatic branches filiform. Dry fruit, indehiscent, obovoid, ca 6 × 4 mm, spongy pericarp, green, reddish-vinous when mature (Fig. 2A–D).

## Discussion

The first record of *Diodia kuntzei* in Acre reflects the need to increase sampling (in all seasons of the year), even in well-collected areas where herbaceous plants occur, in northern Brazil. As the most widely distributed species of *Diodia* in South America, the occurrence of *D. kuntzei* in Acre was expected, based on the distribution model by Zappi et al. (2016), who used topographic and climatic data. Most of the herbarium collections mentioned above are more than 30 years old, and, in most cases, specimens are composed of only fragments. Therefore, new collections from new localities are necessary to assess this species' distribution.

According to Pott and Pott (2000) and Pivare et al. (2008), *D. kuntzei* is a pioneer amphibious macrophyte, which grows along the margins of lagoons and temporary inundated fields. Rocha et al. (2007) noticed an adaptive plasticity in *D. kuntzei*, occurring in all environments during the flood period.

Moreover, Rebellato and Cunha (2005), when evaluating the floristic similarity index between the rainy and dry periods, stated that *D. kuntzei* is a therophyte that predominates in both seasons, with cover values and relative frequencies of 17.19–8.80 and 17.35–10.49, respectively.

This species has also been reported as having an acaricidal activity against larvae of *Rhipicephalus microplus* Canestrini, 1888 with efficiency greater than 95%

(Santos et al. 2013). Other authors reported that it is among the 286 forage species in the Nhecolândia sub-region, Pantanal de Mato Grosso do Sul (Santos et al. 2002).

In this study, we present the most western record ever observed for *Diodia kuntzei*; the nearest previously known occurrence of this species is about 800 km. This leads us to conclude that although the diversity of Rubiaceae in the Alto Juruá region is known (Daly and Silveira 2008; Medeiros et al. 2014), new records are possible, mainly due to the size of the area and the paucity of studies at this time.

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## Authors' Contributions

MCS collected and identified the specimen. AACF confirmed the identification. MCS, AACF, MS, and MVAL wrote and/or revised the manuscript. MVAL made the distribution map.

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