

Amaranthus powellii (Amaranthaceae), a new addition for the flora of India and a preliminary list of the Indian *Amaranthus* species

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Abstract

Three populations of *Amaranthus powellii* were discovered in Kerala region (SE-India), representing the first record of this species for the national flora. A morphological description based on the Indian plants, as well as ecological data are given. A preliminary list of all the *Amaranthus* species occurring in India, which was never published during the last 136 years, is also provided.

Izvešček

V regiji Kerala (JI-Indija) smo odkrili tri populacije vrste *Amaranthus powellii*, ki predstavljajo prvo najdbo te vrste v flori Indije. Na osnovi primerkov iz Indije smo podali morfološki opis in ekološke podatke. Sestavili smo tudi seznam vseh vrst rodu *Amaranthus* z območja Indije, ki je ponovno objavljen po 136 letih.

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Introduction

The genus *Amaranthus* L. (Amaranthaceae Juss.) includes 65–70 species of which approximately half are native to the Americas (see Mosyakin & Robertson 1996, Iamónico 2015a). Some species are used as ornamentals, food or medicine and are able to escape from cultivation, negatively impacting the agricultural systems and/or the natural vegetation (see Iamónico 2010, 2015a, Das 2016).

Amaranthus is a taxonomically critical genus, due to its high phenotypic variability which has resulted in the current nomenclatural confusion and misapplication of several names (see e.g., Costea et al. 2001, Bayón 2015, Iamónico 2016a, 2016b, 2016c, 2020a, 2020b, 2020c Iamónico & Palmer 2020).

As part of an ongoing investigation on the Indian species of *Amaranthus* (Iamónico & Das 2014, Arya et al. 2019, Sindhu et al. 2020), we found some populations of *Amaranthus powellii* S. Watson, a species never recorded for the national flora. Morphological notes, as well as ecological data are presented here. A preliminary list of all the *Amaranthus* species occurring in India, which were never published since 136 years, is also provided.

Materials and methods

The research is based on field surveys [collected specimens are deposited at CALI, HFLA, and TBGT], analysis of relevant literature, and examination of specimens preserved at AO, APP, FI, HFLA, G, GH, K, KFRI, MH, NY, RO, and TSB (herbarium codes follow Thiers 2021 [continuously updated]).

The description of the species is based on the plants observed in field.

Results and discussion

First record for Indian flora

Amaranthus powellii, a species originally described by Watson (1875: 347) from Arizona, is native to North America and Mexico (see e.g., Mosyakin & Robertson 2003), whereas it was considered as alien in North and Central Africa [Morocco and Algeria (see Iamónico 2015b, SANBI 2012), Ethiopia, Uganda, and Tanzania (see Costea et al. 2001)], Asia [Pakistan (see Costea et al. 2001), and Korea (Park et al. 2014)], Australia (Palmer 2009), and Europe (Iamónico 2015b).

Three populations of *Amaranthus powellii* were found in South India, Kerala State, Kasaragod District, in Chengala suburb (localities Naimarmoola and 4th Miles) and Mulleria town (Figure 1), at elevation 54–173 m a.s.l.



Figure 1: *Amaranthus powellii* in India (photos by A. Sindhu).
Slika 1: *Amaranthus powellii* v Indiji (fotografije A. Sindhu).

The first observation of *Amaranthus powellii* was in 2018 and the populations found still occur in the above mentioned sites. A total of 27–35 individuals were counted in these sites occupying an area of about 3 m² per site. We observed the flowering and fruiting times from June to February. On the basis of literature (see the above mentioned citations and the paragraph 3.2 below), these populations represent the first record of this species for the Flora of India (see also POWO 2020-onward).

Since the recent observation (2018) and the low number of individuals found (27–35), although the population seems fertile, we consider *Amaranthus powellii* as a casual alien species for India according to Pyšek et al. (2002). However, future monitoring will be carried out to check the possible naturalization of the species.

Amaranthus powellii S.Watson., Proc. Amer. Acad. Arts 10: 347. 1875 ≡ *Amaranthus chlorostachys* var. *powellii* (S.Watson) Priszter, Agrártud. Egyet. Kert- Szőlőgazdaságtud. Karának Évk. 2: 144. 1953 ≡ *Amaranthus hybridus* subsp. *powellii* (S.Watson) Karlsson, Nord. J. Bot. 20: 519. 2000 ≡ *Amaranthus hypochondriacus* var. *powellii* (S.Watson) Pedersen, Monogr. Syst. Bot. Missouri Bot. Gard. 74: 1245. 1999 ≡ *Amaranthus retroflexus* var. *powellii* (S.Watson) B.Boivin, Naturaliste Canad. 93(5): 641. 1966 – Lectotype (designated by Iamónico 2015: 157): USA, Arizona, “from Powell’s Arizona seeds”, 1874, *Powell s.n.* (US00106256!). Image of the lectotype available

at <http://n2t.net/ark:/65665/m3d80bd736-5d12-4c99-a23a-1383db663680>

Description: annual herb (therophyte), monoecious, 200–250 cm tall. Stem erect, reddish, glabrous (pubescent in the synflorescence region), ribbed, branched at the proximal half. Leaves simple, alternate, ovate-rhombic (10.5–14.5 × 4.5–9.5 cm), green, with entire margin, apex usually slightly emarginated, mucronate, base cuneate, glabrous, petioled (petiole pubescent, 12–14 cm long). Synflorescence terminal, panicle-like, few branched, the main florescence 28–30 × 2–3 cm, the paraclades 15–16 × 1.5–2.0 cm. Bracts lanceolate-subulate (7.0–8.5 mm long), 2.8–5.5 times longer than the perianth, green, glabrous, awned, with membranous borders narrowing to apex. Staminate flowers occurring throughout the synflorescences, with 5 unequal tepals, lanceolate-oblong (2.5–3.4 mm long), mucronate; stamens (4–)5; anthers sagittate. Pistillate flowers occurring throughout the synflorescence, with 5 unequal tepals, lanceolate-linear (3.1–4.2 mm long), with acute and mucronate apex; gynoecium green, ovary 1-celled, 1 ovule, glabrous; stigmas 2–3. Fruit brown, ovoid (1.3–1.8 × 0.8–1.2 mm), shorter than the perianth, dehiscent. Seed lenticular (0.5 × 0.6 mm in diameter), black to reddish-brown.

Phenology: Flowering and fruiting times June–February.

Habitat, distribution, and status of naturalization in India: *Amaranthus powellii* occurs in waste lands in three sites of Kasaragod District (Kerala State) at Chengala suburb [localities Naimarmoola (54 m a.s.l.) and 4th Miles (83 m)] and Mulleria town (173 m). This species is currently considered as casual alien.

Chorology: native to North America and Mexico (see e.g., Mosyakin & Robertson 2003). Some authors (e.g., Iamónico 2015a or Costea et al. 2001) considered *Amaranthus powellii* as native to North and South America.

Taxonomic notes: On the basis of the personal observation on hundreds of plants (by DI) and literature data, the Indian plants differ from the typical *Amaranthus powellii* by plant size and by the length of the bract of pistillate flowers. Concerning the height of plant, Indian plants of *A. powellii* are over than 2 m tall, while this species is usually up to 1.5 m high (see e.g., Mosyakin & Robertson 2003, Iamónico 2015a). However, it is well known that this feature does not have a taxonomic value in *Amaranthus* and it depends from ecological factors, such as light, available nitrate in soil, trampling, etc. (see e.g., Iamónico 2010, Costea et al. 2004). On the other hand, the length of the bracts is a character commonly used to identify taxa in *Amaranthus* and especially in the *A. hybridus* group, where *A. powellii* belongs (see e.g., Iamónico 2015a). Individuals of *A. powellii* found in

India display bracts 7.0–8.5 mm long, whereas this species shows bracts up to 7 mm long (see e.g., Mosyakin & Robertson 2003, Iamónico 2015a). The ratio bract/perianth (also a good taxonomic character in *Amaranthus*) is about 2.8–5.5 in the Indian plants, whereas it is 2.0–3.7 in *A. powellii*.

Specimina Visa Selecta: INDIA. *Naimarmoola* Kasaragod (north east), small population in the market road, 12°51'52" N, 75°02'27" E, 54 m a.s.l., 10.X.2019, *V S Anilkumar s.n.* (CALI). *4th Mile* (Kasaragod, South), scattered populations, 12°51'07" N, 75°03'79" E, 83 m a.s.l., 20.IX.2019, *V S Anilkumar s.n.* (TBGT). *Mulleria* (Kasaragod, North), along road sides and wastelands, 12°54'87" N, 75°16'52" E, 173 m a.s.l., 20.II.2020, *V S Anilkumar s.n.* (TBGT).

List of *Amaranthus* species occurring in India

At the current state of knowledge, no list of the species belonging to the genus *Amaranthus* has been published for the whole India since 1885, when Hooker (1885: 718–722), in the volume no. 4 of his *Flora of British India*, recognized 10 species plus three further “doubtful species”. However, according to the current species concept in *Amaranthus*, only 8 species can be accepted (see Table 1 and literature therein cited).

Before Hooker (1885), a complete taxonomic treatment of *Amaranthus* for India was published by Roxburgh (1832) in the 3rd volume of his *Flora Indica* where 18 species was recognized, but they currently refer to 6 species and 7 taxa (see Table 2 and literature therein cited).

During the XX century, no taxonomic revision of *Amaranthus* was published for the India subcontinent, and we were able to trace just one taxonomic paper by Thakur (1967), who clarified the identity of the name “*Amaranthus caturus* Heyne” reaching to the conclusion that it refers to a hybrid between *A. tricolor* L. and *A. viridis* L.

Concerning XXI century, several new taxa were published by Das (2013), who described a new variety of *A. tricolor* L. (var. *acutus* Sabuhik Das), Das (2014, *A. paraganensis* Sabuhik Das), Iamónico & Das [2014, *A. bengalensis* Iamónico & Sabuhik Das (as “*bengalense*”)], Arya et al. (2019, *A. saradhiana* Arya et al.), and Sindhu et al. (2020, *A. rajasekharii* Sindhu et al.). Note that Das (2014) also reported from West Bengal *A. dubius* Mart. ex Thell. and *A. hybridus* L.

Currently, 19 taxa of *Amaranthus* (17 species) occur in India (Table 3), and this represents the first preliminary list of Indian amaranths published since 136 years.

Table 1: List of recognized species by Hooker (1885: 718–722) as reported in the vol. 4 of *Flora of British India* [doubtful species by Hooker (1885) are marked with an asterisk, *] and names currently accepted (if accepted names are different from the Linnaean ones, a reference is reported).

Tabela 1: Seznam vrst, ki jih je navedel Hooker (1885: 718–722) v četrtem delu *Flora of British India* [dvomljive vrste po Hooker (1885) so označene z zvezdico, *] in trenutno veljavna imena (če se veljavno ime razlikuje od Linnejevskih je neveden vir).

Recognized species by Hooker (1885)	Currently accepted names
<i>Amaranthus spinosus</i> L.	<i>Amaranthus spinosus</i> L.
<i>Amaranthus paniculatus</i> L.	<i>Amaranthus cruentus</i> L. (Iamónico 2015: 55)
<i>Amaranthus caudatus</i> L.	<i>Amaranthus caudatus</i> L.
<i>Amaranthus gangeticus</i> L.	<i>Nomen Incertae Sedis</i> (Iamónico 2014a)
<i>Amaranthus mangostanus</i> L.	<i>Amaranthus tricolor</i> L. (Iamónico 2014b: 147)
<i>Amaranthus caturus</i> Heyne	<i>Amaranthus</i> × <i>caturus</i> Heyne ex Hook.f. (Thakur 1967)
<i>Amaranthus viridis</i> L.	<i>Amaranthus viridis</i> L.
<i>Amaranthus blitum</i> L.	<i>Amaranthus blitum</i> L. s.str. (Iamónico 2015a: 27)
<i>Amaranthus polygamus</i> L.	<i>Amaranthus tricolor</i> L. (Iamónico 2014b: 148)
<i>Amaranthus tenuifolius</i> Willd.	<i>Amaranthus graecizans</i> L. s.str. (Iamónico 2020b: 152)
<i>Amaranthus atropurpureus</i> Roxb.*	<i>Amaranthus tricolor</i> L. (Iamónico 2020c: 563).
<i>Amaranthus campestris</i> Willd.*	<i>Amaranthus albus</i> L. (Iamónico 2020b: 149)
“ <i>Amaranthus rubricaulis</i> Page”, nom. nud.*	Arts. 38.1 and 38.2 (Turland et al. 2018); see Iamónico (2016c: 89)

Table 2: List of recognized species by Roxburgh (1832: 601–611) as reported in the vol. 3 of *Flora Indica* and names currently accepted.

Tabela 2: Seznam vrst, ki jih je navedel Roxburgh (1832: 601–611) v tretjem delu *Flora Indica* in trenutno veljavna imena.

Recognized species by Roxburgh (1832)	Accepted names
<i>Amaranthus tenuifolius</i> Willd.	<i>Amaranthus graecizans</i> L. s.str. (Iamónico 2020b: 152)
<i>Amaranthus polygonoides</i> Willd.	<i>Amaranthus polygonoides</i> L. (Iamónico 2015a: 43)
<i>Amaranthus polygamus</i> Willd.	<i>Amaranthus tricolor</i> L. (Iamónico 2014b: 148)
<i>Amaranthus tristis</i> Willd.	<i>Amaranthus tricolor</i> L. (Iamónico 2014b: 144)
<i>Amaranthus viridis</i> Willd.	<i>Amaranthus viridis</i> L. (Iamónico 2015a: 22)
<i>Amaranthus lividus</i> Willd.	<i>Amaranthus blitum</i> L. s.str. (Iamónico 2015a: 27)
<i>Amaranthus oleraceus</i> Willd.	<i>Amaranthus blitum</i> L. var. <i>oleraceus</i> (L.) Hook.f. (Iamónico 2015a: 29)
<i>Amaranthus gangeticus</i> Willd.	<i>Nomen Incertae Sedis</i> (Iamónico 2014a)
<i>Amaranthus lanceolatus</i> Roxb.	<i>Amaranthus tricolor</i> L. (Iamónico 2020c: 564).
<i>Amaranthus atropurpureus</i> Roxb.	<i>Amaranthus tricolor</i> L. (Iamónico 2020c: 563).
<i>Amaranthus tricolor</i> Willd.	<i>Amaranthus tricolor</i> L.
<i>Amaranthus melancholicus</i> Willd.	<i>Amaranthus tricolor</i> L. (Iamónico 2015a: 24)
<i>Amaranthus fasciatus</i> Roxb.	<i>Amaranthus blitum</i> L. s.str. (Iamónico, submitted ⁶).




Table 3: Preliminary list of the species of *Amaranthus* occurring in India. Names are given in alphabetical order.

Tabela 3: Preliminarni seznam vrst rodu *Amaranthus*, ki se pojavljajo v Indiji. Imena so navedena po abecednem redu.

<i>Amaranthus albus</i> L.	<i>Amaranthus polygonoides</i> L.
<i>Amaranthus bengalensis</i> Iamónico & Sabuhik Das	<i>Amaranthus powellii</i> S.Watson
<i>Amaranthus blitum</i> L. subsp. <i>blitum</i> var. <i>blitum</i>	<i>Amaranthus rajasekharii</i> S.Arya, V.S.A. Kumar, W.K.Vishnu & Iamónico
<i>Amaranthus blitum</i> L. subsp. <i>blitum</i> var. <i>oleraceus</i> (L.) Hook. f.	<i>Amaranthus saradhiana</i> S.Arya, V.S.A. Kumar, W.K.Vishnu & Rajesh Kumar
<i>Amaranthus</i> × <i>caturus</i> Heyne ex Hook. f.	<i>Amaranthus spinosus</i> L.
<i>Amaranthus cruentus</i> L.	<i>Amaranthus tricolor</i> L. var. <i>acutus</i> Sabuhik Das
<i>Amaranthus caudatus</i> L.	<i>Amaranthus tricolor</i> L. var. <i>tricolor</i>
<i>Amaranthus dubius</i> Mart. ex Thell.	<i>Amaranthus viridis</i> L.
<i>Amaranthus graecizans</i> L. subsp. <i>graecizans</i>	
<i>Amaranthus hybridus</i> L.	
<i>Amaranthus parganensis</i> Sabuhik Das	

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