



New distributional record of two weedy amaranths as leafy vegetables from Odisha, India

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ABSTRACT

Amaranthus, commonly called as “amaranth”, is a wide taxonomic group with a large diversity of species and varieties, embodies several weedy and domesticated forms of great economic importance. A number of species are cultivated as leafy vegetables, pseudo-cereals, food, fodder, medicines and ornamental plants. These are short-lived annual plants which develop vigorously and adapt easily to new environments. During the survey for germplasm collection of minor leafy vegetables and wild relatives of crop plants in parts of Odisha, the occurrence of naturalised populations of two species of wild/weedy *Amaranthus* viz. *Amaranthus blitum* L. and *A. dubius* Mart. ex Thell. were explored from different phyto-geographical zones of the state. On elucidative review, the natural occurrence of these species in the state is found to be new taxonomic records for the flora of Odisha. The present communication deals with information on its taxonomic description, phenology, germplasm collection and photographs to facilitate easy identification and their sustainable use.

Key words: *Amaranthus*, leafy vegetables, new record, Odisha

INTRODUCTION

The genus *Amaranthus* L. commonly called as ‘amaranth’ belonging to the family Amaranthaceae, subfamily Amaranthoideae, is a large plant group harbouring several cultivated and weedy species of great economic importance. The members are annual or short-lived perennial herbs grow vigorously and adapt easily to new environments (Norman, 1992). Although a number of these species are potential, majority are neglected and underutilized crops. Most of the members are cosmopolitan in distribution, found almost in all temperate and tropical countries. The primary centres of diversity are Central and South America, India and South East Asia, whereas the secondary centres of diversity are West and East Africa. A number of amaranth species are

cultivated as leafy vegetables, pseudocereals, food, fodder, cosmetics, medicine and ornamental plants (Prakash and Pal, 1991; Shukla et al., 2003). *Amaranthus* is a wide taxonomic group with a large diversity of species, with specific traits such as resistance to biotic and abiotic stresses, high yields, nutritive, nutraceutical and market qualities (Enoch et al., 2014). It shows a wide variety of morphological diversity among and within certain species resulting in nomenclatural confusions and misapplication of several names. The phylogenetic relationship and taxonomic delimitation in genus *Amaranthus* are still not resolved with absolute clarity. The genus *Amaranthus* comprises 70-75 species, of which approximately more than half are native to the Americas (Costea et al., 2001; Mosyakin and Robertson, 2003; Iamanico, 2015),

however, it constitutes 92 accepted species (POWO, 2021). Mosyakin and Robertson (1996, 2003) divided the genus into three subgenera viz. *Acnida*, *Amaranthus*, and *Albersia* based on morphological parameters and reported 70 species consisting of inflorescences ranging from red, purple, green and gold. Majority species show unisexual flowers and compressed, black, and shiny seeds.

In India, the genus *Amaranthus* is represented by 19 species mainly confined to tropical and peninsular region. Several species are used as ornamentals, food and medicines, and some of them are able to escape from cultivation as weedy relatives on fallow lands, wastelands and roadsides (Das, 2016; Kamble and Gaikwad, 2021). These are short-lived annual plants which develop vigorously and adapt easily to new environments. In India, many of the species in this genus are edible popular leafy vegetables and some are domesticated for their leaves for culinary use (Khurana et al., 2013).

MATERIALS AND METHODS

While conducting exploration missions for germplasm collection of minor leafy vegetables and wild relatives including other crop plants during 2014-2025, the first author observed the occurrence of naturalised populations of two species of wild/weedy *Amaranthus* in different locations of phyto-geographical zones of Odisha. The seed germplasm were collected from the live plants in ripe capsule (utricle) stage in natural habitats and deposited in the National Gene Bank, ICAR-NBPGR, New Delhi for long term conservation. The plant specimens bearing both vegetative and floral parts were deposited in the herbarium of the centre along with one set at the National Herbarium of Cultivated Plants (NHCP), ICAR-NBPGR, New Delhi. The live plants and the herbarium specimens were critically studied and the morphological features of the plant were examined and the distinctive characters were recorded. The photographs of the plant species in the natural habitat were taken for reference.

After thorough examination of morphological characters of the live plants and consultation of herbarium specimens at Central National

Herbarium, CAL, Howrah, along with perusal of relevant literature, these two species of wild amaranths were identified as *Amaranthus blitum* L. and *A. dubius* Mart. ex Thell. On verification of published flora (Haines, 1924; Mooney, 1950; Saxena and Brahmam, 1995), it was found that these taxa have not been so far reported from Odisha. Therefore, the present collection of two species of weedy amaranths count addition of species to the flora of Odisha. A detailed taxonomic description on morphology of two taxa along with field photographs, habitat/ ecology, germplasm collected and conserved were provided for easy identification and further utilization.

Both the species were found in wide range of habitats and grow luxuriantly in disturbed/ partly disturbed areas as weed in different landscapes such as waste lands, fallow fields, roadsides, field bunds and in unutilised farmers' fields in natural habitat and their occurrence were recorded at different locations of Odisha. A total of 42 germplasm accessions comprising *A. blitum* (10) and *A. dubius* (32) were recorded from different locations of phyto-geographical zones of Odisha. Both the species prefer direct sunlight and propagated through seeds and even from stem cuttings.

TAXONOMIC ACCOUNT

Amaranthus blitum L. (Fig. 1)

Amaranthus blitum L. Sp. Pl. 990 (1753); Prain in Bengal Plants 2:871 (1908); Haines Bot. Bihar & Orissa part v: 764 (1924); Giri et al. Mat. Arunanch. Prad. 2:301 (2008); *A. lividus* Hort. Petrop. ex Hook. f. in Fl. Brit. Ind. (J.D.Hooker) 4:721 (1885); *A. ascendens* Loisel. in Not. Fl. France 141 (1810); *A. tenuifolius* Roxb. In Fl. Ind. 3:602 (1832); *Amaranthus graecizans* var. *blitum* (L.) Kuntze in Revis. Gen. Pl. 2: 541 (1891); *Euxolus blitum* (L.) Gren. in Fl. Jurass. 2: 652 (1869); *Glomeraria blitum* (L.) Cav. in Elench. Pl. Horti Matr.: 16 (1803).

Annual herb, up to 30 cm height. Stem thin, procumbent or erect, grooved, simple or sometimes branched from base, glabrous, light green, the lower part of the stem being often ending

in a terminal crown of leaves without spikes or panicle. Leaves small, lamina 1.5-5.0 × 1.0-3.5 cm, dotted, broadly ovate to orbicular, apex distinctly notched, retuse or emarginated to bi-lobed, often mucronate, margin entire or slightly undulate, long-petioled up to 6 cm, with 5-7 sec. nerves; base cuneate. Flower clusters axillary and terminal, cymose; terminal clusters erect spikes or complex thyrsoid cymes. Flowers minute; tepals 3, linear-oblong or lanceolate, mucous or apiculate, 1-1.5 mm long, hyaline; bracts and bracteoles oblong, shorter than tepals. Male flowers: radial; tepals 3, ovate, light green, stamens 3, slightly shorter than perianth; female flowers: radial, tepals 3, equal to subequal, oblong-lanceolate, elliptic, stigmas 3 or 2, falling off when utricle ripen. Utricle globose with short obtusely conical tip, membranous, indehiscent, slightly rugose to nearly smooth. ca. 3 mm. Seeds subglobose or broadly lenticular, smooth or slightly rugose, black or dark reddish brown, shiny, ca. 1.2 cm in diam. margins acute. Flowering and fruiting: November to January

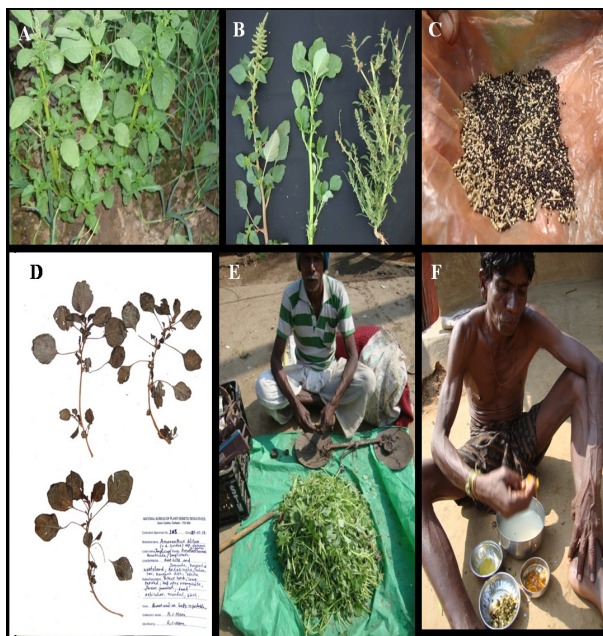


Fig. 1. *Amaranthus blitum*: A. Natural occurrence on a wasteland at Banki block, Cuttack; B. Twigs showing morphological differences among *A. viridis*, *A. blitum* and *A. spinosus* (L-R); C. Seeds of *A. blitum*; D. Herbarium preserved at ICAR-NBPGR, Cuttack; E. Sale of sag at Nayagarh market; F. Consumption of cooked leafy vegetable by a rural man.

Distribution

The species is native to Mediterranean region and the range extends from Peru to Brazil, Bolivia, Chile, Paraguay and Argentina. Further, it is gradually naturalised in different parts of the globe. Some records were also available in different synonyms as *A. lividus*, in which it was reported to be cultivated or run wild in India in the Western Ghats and few states like Karnataka, Maharashtra, Goa, Tamil Nadu, Bihar, Uttar Pradesh, Haryana, Arunachal Pradesh, Jammu & Kashmir (Hooker, 1885; Saldanha, 1984; Almeida, 1990; Rao, 1986; Singh et al., 2001; Verma, 1993; Prain, 1908). It has been cultivated in Europe as a minor leafy vegetable crop, but now it is declining and its range is becoming progressively smaller. In many temperate countries (in particular in Europe), *A. blitum* persists mostly as an uncommon and sporadic weed in greenhouses, ornamental gardens, and flower beds. It flourishes in loamy soils with moderate rainfall, being a small plant, it can be challenging to distinguish from other closely related amaranth species, such as *A. viridis*.

Specimens examined and germplasm collected and conserved

Ten germplasm accessions of *A. blitum* were explored from different landscapes of Odisha and information on details of accession number, date of collection, habitat, frequency and sites of specimen collection were provided in Table 1. The detail vegetative and floral characters of specimens were examined and identified.

Ethno-botanical uses

The tender shoots and leaves are consumed as green leafy vegetable in various culinary traditions (Fig.1F). The chopped leaves can be eaten cooked like spinach and are often added to soups. The leaves are also mixed with corn or rice flour, fried and made into tasty cakes. It is used as animal food and a medicine, has environmental uses and for food.

Table 1. Specimens of *Amaranthus blitum* examined and seed germplasm collected and conserved

Sl. No	Coll. No.	IC. No.	Vernacular name	Date of collection	Source	Frequency	Site of collection			
							Village	Block	District	State
1	RCM/PKS/09	610680	Jungli khada	13.01.14	Wasteland	Occasional	Bilipada	Banki	Cuttack	Odisha
2	RCM/PKS/75	610742	Khunta sag	18.01.14	Disturbed wild	Occasional	Jamutia	Loisingha	Bolangir	Odisha
3	RCM/PKS/81	610748	Patar sag	18.01.14	Disturbed wild	Occasional	Chudapali	Bolangir	Bolangir	Odisha
4	RCM/PKS/84	610751	Bana khada	18.01.14	Wasteland	Occasional	Tusharbahal	Bolangir	Bolangir	Odisha
5	RCM/PKS/91	610757	Bana khada	19.01.14	Disturbed wild	Frequent	Barpadar	Patnagarh	Bolangir	Odisha
6	RCM/PKS/104	610769	Bana khada	20.01.14	Disturbed wild	Occasional	Tambipadar	Khaprakhol	Bolangir	Odisha
7	RCM/PKS/134	610796	Bana khada	22.01.14	Disturbed wild	Occasional	Kodasingha	Padampur	Bargarh	Odisha
8	RCM/PKS/148	610809	Jangli khada	23.01.14	Disturbed wild	Occasional	Jamurda	Bargarh	Bargarh	Odisha
9	RCM/PKS/149	610810	Jangli khada	23.01.14	Disturbed wild	Occasional	Jamurda	Bargarh	Bargarh	Odisha
10	RCM/PKS/154	610814	Nali khada	24.01.14	Disturbed wild	Occasional	Badakera	Anugul	Anugul	Odisha

***Amaranthus dubius* Mart. ex Thell. (Fig. 2)**

A. dubius Mart. ex Thell. Fl. Adv. Montpellier 203 (1912); *Amaranthus dubius* Mart. in Pl. Hort. Erlang. 197 (1814), nom. nud.; *Amaranthus dubius* var. *crassispicatus* Suess. in Mitt. Bot. Staatssamml. München 1: 73 (1951); *Amaranthus incomptus* Willd. in Enum. Pl. Hort. Berol., Suppl.: 64 (1814), nom. Nud.; *Amaranthus hybridus* f. *acicularis* Suess. in Mitt. Bot. Staatssamml. München 1: 4 (1950); *Amaranthus spinosus* f. *inermis* Lauterb. & K. Schum. in Fl. Schutzgeb. Südsee 305 (1900).

Annual herb, up to 1m tall (sometimes 1.50 m). Stem erect, more or less stout, branched, glabrous or sparsely pubescent in distal parts, very often pinkish red, sometimes green. Leaves alternate, ovate or rhomboid-ovate to elliptic, 3-12 × 2-8 cm, petiole up to 7 cm, petiole of proximal leaves equalling or longer than blade, becoming shorter distally; base cuneate, margins entire, apex acute to faintly obtuse, mucronate, glabrous above, pubescent on nerves beneath; Inflorescences in terminal panicles and axillary spikes; panicles erect or very often drooping, the terminal one up to 20 cm long, green in young and brownish in ripe, dense; bracts linear to lanceolate, ca 2mm, shorter than tepals, apex spinescent, greenish-white. Pistillate flowers: radial, tepals 5, oblong-spathulate, not clawed, 1.5-2.5 mm, apex pointed, shortly mucronate, yellowish, ovary 1-celled, style branches spreading, stigmas 3. Staminate flowers: radial, tepals 5, equal or subequal; stamens 5, ca 2

mm long; clustered at tips of inflorescence branches, sometimes gathered in proximal glomerules. Utricles ovoid to subglobose or urceolate, 1.5-2 mm, slightly shorter than tepals, beaked, smooth or wrinkled, dehiscence circumscissile, 1-seeded. Seeds dark reddish brown to black, subglobose or lenticular, 0.8-1 mm diameter, shiny, smooth. Flowering and fruiting: December to January.



Fig. 2. *Amaranthus dubius*: A-B. Natural occurrence at Khandapada block, Nayagarh and Dharmagarh block, Kalahandi districts; C. Leaves; D. Apical twigs; E. Inflorescences in terminal panicles; F. Herbarium preserved at ICAR-NBPGR, Cuttack; G. Seeds; H. A tribal man collects leaves for consumption .

Distribution

The species is native to South America, Mexico and West Indies, however, it is widely spread throughout the world and naturalised in tropical and subtropical regions of United States, Africa, Asia, Australia and the Pacific (CABI, 2019). It was reported to be run wild and domesticated in several parts of India from the states of Maharashtra, Tamil Nadu, Kerala, Andhra Pradesh, Madhya Pradesh, Himachal Pradesh etc. (Khanna et al., 2001).

Specimens examined and germplasms collected and conserved

A total of 32 germplasm accessions of *A. dubius* were collected from different landscapes of Odisha and passport information on details of accession number, date of collection, habitat, frequency and sites of specimen collection were provided in Table 2. The morphological characters of specimens were examined and identified.

Table 2. Specimens of *Amaranthus dubius* examined and seed germplasm collected and conserved

Sl. No	Coll. No.	IC. No.	Vernacular name	Date of collection	Source	Frequency	Site of collection			
							Village	Block	District	State
1	RCM/PKS/02	610673	Dhala khada	13.01.14	Farmer's field	Frequent	Bramanigan	Baranga	Cuttack	Odisha
2	RCM/PKS/05	610676	Khada	13.01.14	Farmer's field	Occasional	Kainmumdi	Baranga	Cuttack	Odisha
3	RCM/PKS/21	610691	Nali khada	14.01.14	Farmer's field	Frequent	Talasahi	Khandapada	Nayagarh	Odisha
4	RCM/PKS/25	610695	Dhala khada	14.01.14	Farmer's field	Occasional	Gopinathpur	Khandapada	Nayagarh	Odisha
5	RCM/PKS/29	610698	Dhala khada	15.01.14	Farmer's field	Frequent	Bhatasahi	Nayagarh	Nayagarh	Odisha
6	RCM/PKS/33	610701	Nali khada	15.01.14	Farmer's field	Frequent	Patharpunja	Daspalla	Nayagarh	Odisha
7	RCM/PKS/34	610702	Dhala khada	15.01.14	Farmer's field	Frequent	Patharpunja	Daspalla	Nayagarh	Odisha
8	RCM/PKS/39	610707	Nali khada	15.01.14	Farmer's field	Frequent	Patharpunja	Daspalla	Nayagarh	Odisha
9	RCM/PKS/117	610780	Khada sag	21.01.14	Farmer's field	Occasional	Munekel	Paikamal	Bargarh	Odisha
10	RCM/PKS/121	610784	Khada sag	22.01.14	Farmer's field	Occasional	Barhiapalli	Padampur	Bargarh	Odisha
11	RCM/PKS/124	610787	Khada sag	22.01.14	Farmer's store	Occasional	Amamunda	Padampur	Bargarh	Odisha
12	RCM/PKS/127	610789	Desi khada	22.01.14	Farmer's field	Frequent	Nuapalli	Padampur	Bargarh	Odisha
13	RCM/PKS/128	610790	Gachha khada	22.01.14	Farmer's field	Occasional	Kodasingha	Padampur	Bargarh	Odisha
14	RCM/PKS/135	610797	Khada sag	23.01.14	Farmer's store	Occasional	Nileswar	Bargarh	Bargarh	Odisha
15	RCM/PKS/141	610803	Chilkani khada	23.01.14	Farmer's field	Occasional	San Dumerpalli	Bargarh	Bargarh	Odisha
16	RCM/PKS/144	610805	Agala khada	23.01.14	Farmer's field	Frequent	Patharla	Bargarh	Bargarh	Odisha
17	RCM/MRS/46	641717	Nali banakhada	18.12.20	Wasteland	Occasional	Sugar factory	Aska	Ganjam	Odisha
18	RCM/MRS/50	641718	Nali khada	18.12.20	Wasteland	Occasional	Katakala	Buguda	Ganjam	Odisha
19	RCM/SS/21	641743	Khunta saga	04.03.21	Disturbed wild	Occasional	Parukunda	Barkote	Deogarh	Odisha

20	RCM/SS/33	641751	Khunta saga	05.03.21	Disturbed wild	Occasional	Machurinali	Banei	Sundargarh	Odisha
21	RCM/SS/35	641753	Khunta saga	05.03.21	Fallow land	Occasional	Kaliposh	Lahunipada	Sundargarh	Odisha
22	RCM/SS/73	641777	Khunta saga	08.03.21	Fallow land	Occasional	Suruguda	Lephripada	Sundargarh	Odisha
23	RCM/SS/76	641780	Khunta saga	09.03.21	Wasteland	Occasional	Nakshapalli	Maneswar	Sambalpur	Odisha
24	RCM/BV/PK/24	649114	Khunta saga	09.12.22	Disturbed wild	Occasional	Kendrikela	Bonai Ghosh	Sundargarh	Odisha
25	RCM/MKM/25/14	658087	Janglikhada	16.01.25	Disturbed wild	Occasional	Dhumabhata	Belparha	Balangir	Odisha
26	RCM/MKM/25/20	658088	Janglikhada	17.01.25	Disturbed wild	Occasional	Phasad	Puintala	Balangir	Odisha
27	RCM/MKM/25/75	658093	Patarsag	21.01.25	Wasteland	Occasional	Bhoirajpur	Khariar	Nuapada	Odisha
28	RCM/MKM/25/83	658095	Patarsag	22.01.25	Wasteland	Occasional	Gudguda	Titlagarh	Balangir	Odisha
29	RCM/MKM/25/98	658098	Patarsag	23.01.25	Wasteland	Frequent	Kendubahali	Narla	Kalahandi	Odisha
30	RCM/MKM/25/113	658099	Khunta sag	25.01.25	Wasteland	Occasional	Badabasula	Dharmagarh	Kalahandi	Odisha
31	RCM/MKM/25/117	658101	Patarsag	25.01.25	Disturbed wild	Occasional	Pandigan	Kalampur	Kalahandi	Odisha
32	RCM/MKM/25/138	658102	Patarsag	28.01.25	Disturbed wild	Occasional	Rayagada	Rayagada	Rayagada	Odisha

Ethno-botanical uses

The dark green tender leaves are plucked and cooked as green leafy vegetable with brinjal, pumpkin and tomato and consumed as curry or *bhaji* during the day meal. The leaves are also mixed with corn or rice flour and onion, fried and taken as delicious cakes. It is also used as cattle food and medicine. The seeds are fried and consumed by the rural poor people.

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