



## The taxonomic status of two geophytic *Euphorbia* species (Euphorbiaceae) from Maharashtra, India

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### Abstract

In the present communication, we resurrect *E. khandallensis* and synonymize *E. panchganiensis* under it owing to the overlap of distinguishing characters, as inferred from literature and first hand observations. We further provide an amended description of *E. khandallensis* along with critical notes on its taxonomy and distribution.

### Introduction

The family Euphorbiaceae shows a wide range of distribution in the tropical and subtropical regions of the world, with about 410 species reported in India (Balakrishnan *et al.* 2012). Molecular evidence has resulted in a major reclassification of Euphorbiaceae (Wurdack *et al.* 2004, Hoffmann *et al.* 2006, Tokuoka 2007). In recent decades, the genus *Euphorbia* Linnaeus (1753: 450) (within Euphorbioideae) has been revised using molecular phylogenies that supported monophyly of the genus and its divisions into four major monophyletic clades (Yang *et al.* 2012, Dorsey *et al.* 2013, Peirson *et al.* 2013, Riina *et al.* 2013). The genus *Euphorbia* is represented by about 84 native species in India (Balakrishnan *et al.* 2012). Species of *Euphorbia* sect. *Rhizanthium* Boissier (1862: 10), as treated by Balakrishnan *et al.* (2012) in India, are diagnosed by their geophytic nature, underground fleshy rootstocks, reduced stems, radical leaves and mostly hysteranthous (rarely synanthous) phenology (Balakrishnan & Chakrabarty 2007, Balakrishnan *et al.* 2012). With the establishment of synonymy of sect. *Rhizanthium* with subgenus *Athymalus* Necker ex Reichenbach (1829: 194) (Peirson *et al.* 2013), and the transfer of Indian geophytic *Euphorbia* species to subgenus *Euphorbia* (Dorsey *et al.* 2013), there have been considerable changes in the taxonomic position of several Indian taxa.

The geophytic species recorded under subgenus *Euphorbia* in India by the aforementioned sources are: *Euphorbia fusiformis* Buch.-Ham. ex Don (1825: 62), *E. meenae* Carter (2000: 210), *E. nana* Royle (1836: 329) and the recently described *E. seshachalamensis* Prasad & Prasanna (2016: 73). *Euphorbia acaulis* Roxburgh (1832: 472) has been considered as a synonym of *E. fusiformis*, *E. panchganiensis* Blatter & McCann (1930: 353) that of *E. nana*, and *E. khandallensis* Blatter & Hallberg (1921: 48) as a variety of *E. fusiformis* (Govaerts *et al.* 2000, Balakrishnan & Chakrabarty 2007, Aditya 2010, Balakrishnan *et al.* 2012, The Plant List 2013). Upon examination of several specimens in the field, we realized the need to rectify the taxonomic status of two geophytic Euphorbias, namely *E. panchganiensis* and *E. khandallensis* from the state of Maharashtra. The present paper thus deals with the taxonomic status of the two species with notes on their distribution.

### Resurrection of *E. khandallensis*

Balakrishnan & Chakrabarty (2007) have included *E. khandallensis* as a variety of *E. fusiformis* (*E. fusiformis* var. *khandallensis* (Blatt. & Hallb.) Binojkumar & Balakrishnan 2010: 280). Although Aditya (2010), in his revision of Indian geophytic Euphorbias referred to *E. khandallensis* as an accepted species, he did not discuss the taxonomic

change made earlier by Balakrishnan & Chakrabarty (2007) and also did not explicitly resurrect it from its varietal rank. Later, Balakrishnan *et al.* (2012) retained the varietal rank of this taxon, creating further ambiguity. The major difference between *E. fusiformis* and *E. khandallensis* is the length of the cyathial pedicel (technically peduncle, referred to as pedicel by Balakrishnan *et al.* 2012), which is up to 5 cm in the former and 0.5 cm in latter (see Balakrishnan *et al.* 2012). Secondly, the roots of *E. fusiformis* are typically fusiform while in *E. khandallensis* they are highly irregular and never fusiform. Additionally, *E. fusiformis* is a widely distributed species and *E. khandallensis* a very restricted one. Hence, considering *E. khandallensis* as variety of *E. fusiformis* cannot be justified. Therefore, we propose to resurrect the specific status of *E. khandallensis* here based on the above mentioned differences. We believe that *E. acaulis* should be considered a synonym of *E. fusiformis* subject to further scrutiny (Balakrishnan *et al.* 2012).

### Taxonomic identity of *E. panchganiensis*

Blatter & McCann (1930) described *E. panchganiensis* as a species distinct from *E. khandallensis* based on the number of cymes and bracts, styles and seed characters. The consideration of *E. panchganiensis* as a synonym of *E. nana* by Balakrishnan & Chakrabarty (2007) has been recently questioned (Aditya 2010) and we second the opinion of Aditya (2010). *Euphorbia panchganiensis* and *E. khandallensis* show several overlapping characters as evident from literature, herbarium records and our primary field observations. The Table 1 shows differences between two species as mentioned in literature and our remarks alongside each character. Considering the variability of the diagnostic characters of *E. panchganiensis* and apart from a couple of qualitative characters like color, there is no clear distinguishing character between both species under consideration. Thus, we hereby propose that *E. panchganiensis* be synonymized under *E. khandallensis* and the latter name be retained following McNeill *et al.* (2012). A brief re-description of the species is provided herewith along with photographic description (Figure 1) to aid field identification of *E. khandallensis*.

### Taxonomic treatment

*Euphorbia khandallensis* Blatter & Hallberg (1921: 48).

Type:—INDIA. Maharashtra state: Khandalla, April 1918, C. McCann 12678 [holo BLAT 89276 (photo!)]

*Euphorbia panchganiensis* Blatter & McCann (1930: 353), *syn. nov.*

Type:—INDIA. Maharashtra state: Panchgani tableland, April 1926, C. Blatter & C. McCann 102 [holo BLAT 89277 (photo!).]

**Amended description:**—Perennial geophytic herb; with underground tuberous rootstock about 5–70–1 × 15 cm. Stem short, underground. Leaves appearing after flowers, 3–30 × 2–11 cm, radical, elliptic to oblong or broadly lanceolate or oblanceolate or obtuse to rounded, green, reddish-purple or mottled, fleshy; entire or undulate along margins; sessile or with petioles less than 5 cm long; base cuneate, attenuate; apex acute to mucronate or obtuse or retuse. Entire inflorescence up to 18 cm long, cyathia arranged in cymes. Primary peduncles 2–6 from underground stem, each up to 10 cm long, with dichotomous branching up to 5 times. Cyathial pedicels ca. 0.5 cm long. Bracts variable in shape and colour, ca. 6 mm long, triangular or lanceolate or semi-cylindrical, amplexicaul at base, apex acute, margin wavy or dentate or entire, 1 nerved, scarious, pink or greenish fading to white. Involucre 3–6 × 4–5 mm, lobes 4–6, oblong, fimbriate, pectinate, reddish or greenish; glands 4–6, reddish or greenish transversely oblong, 0.5–1 × 1–2 mm. Male florets 5, pedicels ca. 1.5 mm long; anthers ca. 0.6 mm broad, sub-globose, purple, opening at apex, pollen yellow; bracteoles spatulate, lacinate. Female floret with gynophores ca. 3mm long in early stages and elongating till maturity, ovary sub-globose, styles ca. 0.5 mm long, connate at the base or upto the middle, stigma papillose. Capsule sub-globose, trilobed with 3 cocci (rarely 4), ca. 6 mm across. Seeds globose to spherical, ca. 3 mm in diameter, black and grey variegated.

**Phenology:**—Plants are hysteranthous. Flowers appear in the dry season from January to May and fruiting immediately after flowering. Leaves appear after the first rains from June onwards and wilt after October.

**Critical notes:**—The present communication deals with only two of the geophytic *Euphorbia* in India and we hope that this will facilitate research on the identity of the rest. Dorsey *et al.* (2013) in their work have sampled *E. fusiformis*, *E. nana* and *E. meenae* for phylogeny, but have not sampled *E. khandallensis* and *E. panchganiensis*. Further molecular studies in conjunction with morphometric data might help in resolving the geophytic *Euphorbias* in India.

In the present communication, we are proposing synonymy based solely on morphological characters. Populations of the two species under consideration must be further analyzed using molecular phylogenetic tools with sampling throughout their distribution range for a better understanding of the species delimitation. Specimens from Sinhagad fort, *V.D. Vartak 7123* (AHMA-photo!), from Katraj ghat, *V.D. Vartak 7121* (AHMA), *V.D. Vartak 7122* (AHMA), from Junnar, *S.S. Rahangdale 23364* (AHMA), and from Konkan, Nashik and Thane (pers. obs., SSK) of Maharashtra state with fusiform roots are presumed to be *E. fusiformis* suggesting a broader distribution of the species as opposed to the restricted distribution of *E. khandallensis*; whereas specimens labelled as *E. fusiformis* collected from Ralegaon hill at Junnar, *K. Hemadri 107269* (BSI!), Vikramgad reserve forest at Palghar, *Billore 116381* (BSI!) might represent *E. khandallensis*. Hence, we recommend that the specimens currently classified as *E. fusiformis* and *E. khandallensis* in various local and national herbaria be re-examined.

**TABLE 1.** Published differences between *E. panchganiensis* and *E. khandallensis* and our remarks on how these break down on further scrutiny (sources for data: personal observations, protologues (Blatter & Hallberg 1921; Blatter & McCann 1930); Mishra & Singh 2001; Singh *et al.* 2001; Aditya 2010; Balakrishnan *et al.* 2012. Characters exclusively given/quantified in Aditya (2010) are provided with that reference).

Character	<i>E. panchganiensis</i>	<i>E. khandallensis</i>	Remarks based on literature or field observations
Rootstock	5–20 × 1–7 cm	10–70 × 5–15 cm	Variable according to soil characteristics
Leaf shape, apex, color	Lanceolate or elliptic to oblanceolate. Apex acute, Leaves green or with red patches	Obovate, obtuse to rounded. Apex mucronate, Leaves greenish variegated with red/purple patches	Varies as per locality and microhabitat
Phyllotaxy	Leaves in a rosette (Aditya 2010)	Leaves not in a rosette (Aditya 2010)	Protologues of both the species plus Balakrishnan <i>et al.</i> (2012) say leaves are in a rosette
Petiole length	8–10 mm (Aditya 2010)	5–7 cm (Aditya 2010)	Balakrishnan <i>et al.</i> (2012) report length for both in the range of 2–5 cm which hardly overlaps with the ranges given in Aditya (2010). Several specimens of intermediate length seen in the field
Number of cymes	Numerous	Few	No quantification done and number is highly variable
Inflorescence height	Short (6–8 cm) (Aditya 2010, protologue)	Tall (18–20 cm) (Aditya 2010, protologue)	Several specimens of intermediate length seen on field
Number of involucre lobes and glands	4–6	5	Usually 5 in both species, rarely 4 or 6
Involucral bracts	Triangular-lanceolate, margin wavy	Broadly triangular, acute-mucronate, margin entire	Protologue of <i>E. panchganiensis</i> itself mentions the variable nature of bracts
Color of bracts and involucre	Reddish-pink/ purple/ greenish turning white	Greenish to white	Bract color fades eventually to white for both species
Style	Connate up to the middle	Connate only at the base	Variable, depends upon flower maturity
Seeds	Black to grey	Black and white variegated	Variable character
Elevation	Found at only higher elevations (>1000 m) (Aditya 2010)	Imprecise elevation details given, but <1000 m (Aditya 2010)	No clear preference seen for elevation by <i>E. khandallensis</i>

**Distribution:**—*Euphorbia khandallensis* (= *E. panchganiensis*) is endemic to India. There is a possibility that the specimens examined by Balakrishnan *et al.* (2012) collected from Andhra Pradesh and Tamil Nadu states may be of *E. fusiformis* and need revalidation. The distribution within Maharashtra state of *E. khandallensis* (also includes that of the earlier considered *E. panchganiensis*) is from Khandalla, Lonavala, Purandar (Pune district), Matheran (Raigad district), Panchgani-Mahabaleshwar, Kaas, Chalkewadi, Khambatki ghat (Satara district), and Achre, Kaziwada sada (Sindhudurga district). This may change in the future after thorough field surveys supplemented by re-examination of herbarium specimens.



**FIGURE 1:** Plate depicting variations in *E. khandallensis* (including plants that were formerly determined as *E. panchganiensis*). A. habit ('*E. panchganiensis*'). B. habit ('*E. khandallensis*'). C.: tuberous, branched rootstock ('*E. panchganiensis*'). D. cyathium ('*E. panchganiensis*'). E. cyathium ('*E. khandallensis*')-slightly more mature than D, thus with a long gynophore. F. capsule ('*E. panchganiensis*'). G. cyathia with bracts and six glands in one inflorescence and five in the other ('*E. panchganiensis*'). H. cyathia with bracts, male florets and glands ('*E. khandallensis*'). I. capsules ('*E. khandallensis*'). J. leaves ('*E. panchganiensis*'). K. leaves ('*E. khandallensis*'). Photographs by Rohit Mane and Ashish Nerlekar, taken at Kaas and Lonavala for '*E. panchganiensis*' and '*E. khandallensis*' respectively.

## Acknowledgements

ANN and SAL thank Gaurang Gowande and Manasi Lapalikar for logistical support and Varun Kher for help in photography. Maharashtra Forest Department is acknowledged for permitting us to carry out field observations. We also thank Dr. K. N. Gandhi for comments on the type material and Dr. N. P. Balakrishnan for providing protologues of both the species. SSK thanks Principal, MVP Samaj's Arts, Commerce and Science College, Tryambakeshwar for necessary facilities. RNM is grateful to the Rajiv Gandhi Science and Technology Commission, Government of Maharashtra for the financial assistance and the Head, Department of Botany, Shivaji University, Kolhapur, for laboratory facilities. We acknowledge the staff of BLAT, BSI and AHMA for allowing access to their herbaria.

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